Spatial and Temporal Changes in Tsunami Risk Perception in Canterbury

A thesis submitted in partial fulfilment of the requirements for the Degree of Master Science in Hazard and Disaster Management in the University of Canterbury

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Abstract

Risk perception for rare, low-probability hazards, such as tsunamis, tends to be low due to individual's unfamiliarity with them and the tendency to see them as synonymous with non-occurrence events. Visitors to an area tend to have even lower risk perception and knowledge of hazards, warning systems and appropriate actions to take during an event. Risk perception, however, can increase, if only temporarily, after a catastrophic event, such as the 2004 Boxing Day tsunami. To determine the changes in resident's knowledge and perception and the differences between those of residents and visitors two surveys were conducted. In the first survey interview style surveying was conducted at eleven locations in the coastal Christchurch and Banks Peninsula area of the Canterbury Region The questionnaire was composed of scaled, open, and closed ended questions and the main themes included knowledge of risk, preparation and warnings, what to do during a tsunami, and changes since the 2004 Boxing Day tsunami. The second survey of five coastal communities was conducted via a postal questionnaire and was aimed at obtaining residential views. Survey data was then analysed with Statistical Package for the Social Sciences (SPSS) statistical software. The residential data was compared with that of the non-residents to determine the differences in perception of residents and visitors. The residential information was then compared with survey data from the 2003 National Coastal Survey. Visitors knew less about general tsunami information such as when the last tsunami occurred and were less likely to believe that a tsunami could occur imminently. Non-residents reported less receipt of information and did considerably less information seeking. Differences in knowledge of warning systems were difficult to ascertain. The Boxing Day event certainly made an impact, increasing people's knowledge and awareness, though most likely only temporarily.

Chapter 1
Introduction

1.1 Introduction

During an average year, there are millions of dollars worth of damage from earthquakes, millions are affected by drought, thousand are killed by floods, and hundreds are left homeless from wind storms and hurricanes (EM-DAT, 2007). In contrast most tsunamis that occur are so small that they go by almost completely unnoticed. This is not the case every year, though, with 1946, 1960, 1998 and especially 2004 bringing devastating tsunamis.

People are familiar with earthquakes, floods, windstorms and droughts because they occur frequently. Individuals have more accurate risk perception for such familiar hazards and are therefore more likely to take preparatory measures before a natural disaster and self-protective actions during an event (Weinstein, 1989). However, many individuals see low-probability events, such as tsunamis, as synonymous with non-occurrence events (Rogers, 1997). Given the low probability of occurrence and a history of minimal damage, individuals are likely to have very low risk perception, little knowledge of the hazard and warning systems and are unlikely to be prepared. With an average of 12-13 one-meter tsunamis each century and higher world population than ever before, the potential for future damage is very great. With the low-probability of occurrence and a history of minimal damage, individuals are likely to have very low risk perception, little knowledge of the hazard and warning system and are unlikely to be prepared.

This is an even greater issue for tourists to an area who are likely to have even less knowledge and awareness of possible hazards and what to do in the event of a tsunami (Alexander, 2002). Tourists also bring a temporary increase the population to an area, further increasing the risk.

However, after a large-scale disaster such as the 2004 Boxing Day Tsunami, changes can occur in perceptions of tsunami hazards, how they are viewed and what is known about them.

1.2 Methodology

To understand individuals' knowledge, understanding and perceptions about various facets of tsunamis are two surveys, were conducted. The first survey was aimed at non-residents at campground sites. Interview-style surveying was conducted at eleven locations in the coastal Christchurch and Banks Peninsula area of the Canterbury Region.

A total of 211 interviews were conducted between December 23rd, 2005 and January 31st, 2006, during the peak holiday occupancy period. The survey questions were based on the National Coastal Survey conducted by Geological and Nuclear Sciences (GNS) in 2003 (Johnston *et al,* 2003). The questionnaire was composed of scaled, open-ended, and closed-ended questions and the main themes included knowledge of risk, preparation and warnings, what to do during a tsunami, and changes since the 2004 Boxing Day tsunamis.

The second survey was aimed at residents of five coastal communities of the Canterbury Region. A postal questionnaire was delivered to residents during October of 2006. All the communities but one were chosen because they were surveyed as part of the National Coastal Survey carried out by GNS in 2003. Addresses from the 2003 survey were reused with 710 surveys were posted initially.

The survey was based on several other surveys to allow cross-comparison of results. The other surveys included the 2003 National Coastal Survey (Johnston *et al,* 2003), the present campground survey of non-residents, and a similar tsunami survey that was conducted in Oregon, USA early in 2006. The questionnaire was composed of scaled, open- and closed-ended questions, and the main themes included risk perception and hazard experience, general tsunami knowledge, tsunami warnings, sources of information and preparedness, and attitude about community.

Survey data were analysed with Statistical Package for the Social Sciences (SPSS) statistical software. The residential data were compared with that of the non-residents to determine the differences in perception between residents and visitors. The residential information was then compared with survey data from the 2003 National Coastal Survey (Johnston *et al,* 2003) to see what changes in perception had occurred since the 2004 Boxing Day tsunami.

Chapter 2

Tsunamis and New Zealand

2.1 Introduction

The following is a Maori account which is estimated to be from 1550 and may describe a tsunami occurring at Taranaki. It is related from **History and Traditions of the Maoris of the West Coast North Island of New Zealand Prior to 1840**:

> Potiki-roa, brother to the great cheiftainess Hine-tu-a-hoanga of Taranaki, was travelling with her to the sight of her husband's death. After landing on the South Island and sighting smoke inland Potiki-roa was sent to investigate the people and get directions. There Potiki-roa became smitten with Puna-te-rito, one of the daughters of the chief, Mango-huruhuru. After Maori tradition she was given to him by her father as a wife. Potiki-roa sent messengers from the village to tell his sister that he would be remaining in the village.
>
> After some years it happened that Potiki-roa wanted to see his old home and asked of his father-in-law to make a visit to Taranaki. Mango-huruhuru consented and a suitable canoe was hewed out and all was made ready for the journey. Potiki-roa, the chief, and the chief's daughters, after a safe voyage, arrived in Taranaki at a place called Potikit-aua. Mango-huruhuru built a large house on low land and close to the sea. There in he dwelled with his youngest daughters, his other daughters quickly marrying into the Taranaki tribe. Potiki-roa built his house further inland and uphill from his father-in-law. Mango-huruhuru, being unhappy with the rocky beach at his new home, decided to use his priestly powers to call the sands from Hawaiki to improve the beach. That evening he climbed to the ridge above his home and called out an invocation to bring the sands. On conclusion of the incantation, the dark cloud, with its burden of sand, and its surface flashing with lighting, reached the shore. 'The women assembled there near the great house, called out in terror "A! the sea rises; the waves and the sand will overwhelm us." In a moment the storm was upon them; a darkness as of night settled down, only illuminated by the vivid lightning, whilst the wind roared, and the rain fell down in sheets of water; the sands came with the storm, and the people in the great black darkness fell where they stood and were buried in the sands. The house and cultivations and all the surrounding country were buried deep in sand, and with them the old priest, Mango-huruhuru, and his daughter Hei-hana… who turned into a rock, which still stands there, "to bear witness to the truth."
>
> Potiki-roa and his wife, Puna-te-rito escapes the disaster from the fact of their home being further inland and on higher ground… Over a

hundred people were killed by the sands, and there bones are still there.' (Smith, 1984).

According to McFadgen (Winder, 2005) there are Maori legends and stories about large waves affecting the Taranaki and Waikato coast and although this could have been a storm surge, it is also likely that this history refers to a tsunami. In pre-European times approximately 30% of Maori lived within half a kilometre of the coast and less than 20 meters above sea level, so would have been at risk from such events (Winder, 2005). Recent paleotsunami research indicates that sites in the Cook Strait region have been inundated by tsunamis and subsequently abandoned by Maori (Goff *et al*, 2001) although prehistoric accounts of tsunamis are rare (Sidle *et al*, 2004) and the paleotsunami database will always be incomplete (Berryman, 2005).

New Zealand is subject to local, regional, and distantly generated tsunamis from spanning a plate boundary which regularly generates large earthquakes (Berryman, 2005) and from being located in the Pacific Ocean which is "by far" the most active zone for tsunamis (Lander, 2003). This makes the country particularly vulnerable to tsunami hazards. With the incomplete and unreliability nature of both oral accounts and the paleotsunami record it is necessary to examine the historical record to get a better understanding of the risk to New Zealand from tsunamis including tsunami sources, locations affected, and possible wave heights and damage.

2.2 Historical Tsunamis

Date		Source Location	Source Mechanism	Max Run-up
1843	8-Jul	Wanganui, NZ	7.5 EQ	0.5
1845	5-Jul	Wanganui, NZ	EQ	1
1848	15-Oct	Lower Wairau Valley, NZ	7.1 EQ	0.36
1848	17-Oct	NZ	7.0 EQ	
1855	23-Jan	W. Wairarapa	8.0 EQ & Landslide	9.1
1856	2-Mar	Canterbury, NZ, Chatham Rise	Unknown	3
1868	13-Aug	Arica, N. Chile	8.6-9.1 EQ	10
1868	18-Oct	Cape Farewell, NZ		
1877	10-May	Inique, N. Chile	8.3-8.8 EQ	3.6
1883	27-Aug	Krakatau, Indonesia	Volcanic & Meteorological	2
1887	10-May	Bay of Islands, NZ	EQ	2
1891	22-Jun	Aotea Harbour, Waikato, NZ	EQ	3
1897	21-Sep	W. Mindanao, Sulu, Philippines	8.5 EQ	
1897	21-Sep	Wellington, NZ	EQ	1
1904	7-Aug	Cape Turnaga, NZ	7.2 EQ	3
1913	22-Feb	Tasman Sea, Westport	6.8 EQ & Landslide	1.5
1917	1-May	Kermadec		

1922	11-Nov	Caldera, N. Chile	8.3-8.5 EQ	0.2
1922	25-Dec	S.E. NZ, Rangiora	6.2 EQ	3
1923	1-Sep	35.23N,135E, Kwanto, Japan	7.9 EQ	<0.1
1927-28		Tolaga Bay, NZ	possible landslide	>4
1929	16-Jun	West Coast, Karamea, NZ	7.5 EQ & Landslide	2.5
1931	2-Feb	N. NZ, Waikare, Hawkes Bay	7.7 EQ & Landslide	15.3
1931	2-Feb	Napier	7.75 EQ	~3
1931	13-Feb	39.7S, 176.7E,	7.1 EQ	
1931	19-Feb	Hawkes Bay, NZ		
1932	15-Sep	N. NZ	6.8 EQ	3
1937	16-Apr	Tonga	8.1 EQ	0.9
1946	26-Mar	NZ	EQ	
1947	25-Mar	Gisborne, NZ	7 EQ & possible landslide	10
1947	6-May	Melanesia	7.6 EQ	6
1947	17-May	NZ, Gisborne	7.2 EQ & possible landslide	6
1950	13-Mar	N. NZ, Bay of Plenty	5.8 EQ	1
1952	4-Nov	SE of Kamchatka		1
1960	22-May	Corral, S. Chile	8.6 EQ	5.5
1964	28-Mar	Gulf of Alaska, USA	8.4 EQ & Landslide	1.5
1970	28-Sep	NZ	5.1 EQ	1
1976	14-Jan	Kermadec	7.8 EQ	0.75
1977	22-Jun	Tonga Trench	7.2 EQ	0.15
1981	25-May	NZ, Macquarie Ridge	7.6 EQ	0.3
1982	19-Dec	Kermadec	7.7 EQ	0.1
1986	October	Kermadec		<0.1
1986	7-May	Andreanof Island, Alaska, USA	8.0 EQ	0.4
1987	20-May	Doubtful Sound, NZ	Landslide	3
1993	June	Kermadec		<0.1
1994	6-Oct	Kuril Islands		<0.1
1995	16-Jan	Kobe, Honshu Island, Japan	6.8 EQ	0.1
1998	25-Mar	Balleny Islands		0.2
1998	17-Jul	Sissano Lagoon, Papua New Guinea	7 EQ	0.1-0.2
1999	26-Nov	Vanuatu	7.5 EQ	0.05
2001	23-Jun	Peru	8.4 EQ	0.55
2003	21-Aug	S. Island, NZ	Landslide	0.15
2004	26-Dec	Indonesia	9.0 EQ	1.05
2006	3-May	Tonga	7.9 EQ	0.08

Table 2.1: Historic tsunamis that have affected New Zealand (deLange and Healy, 1986; deLange and Fraser, 1999; Intergovernmental Oceanic Commission, 2006; NGDC, 2005). See appendix 2 for more details.

With at least 43 events nationwide (Berryman, 2005) (table 2.1) most coastal areas of New Zealand are reported to have experienced tsunamis during the historic period (figure 2.1) (deLange and Healy, 1986). On average there are 12-13 tsunamis exceeding 1m every century, a similar frequency to that of Indonesia and Hawaii (deLange and Fraser, 1999).

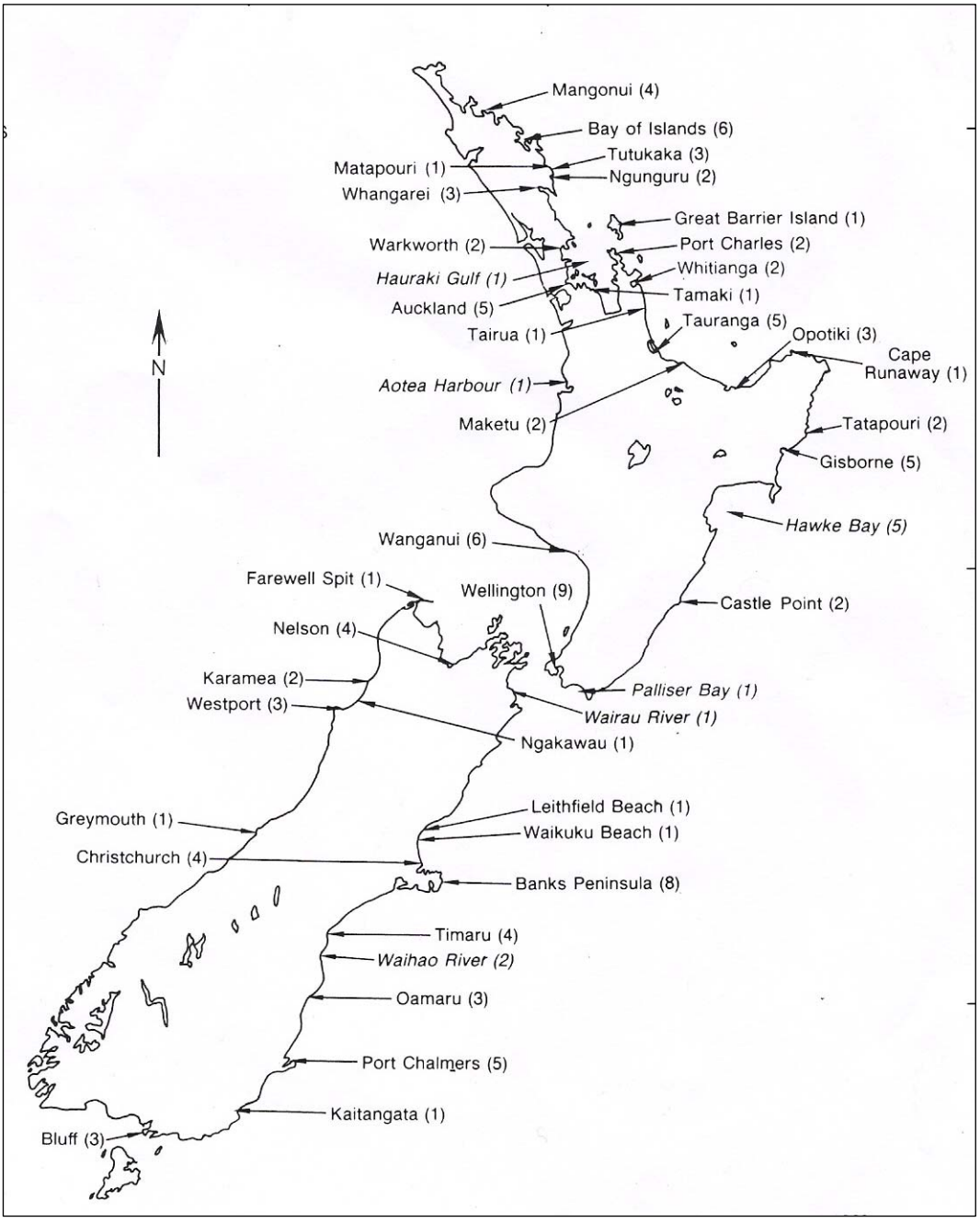


Figure 2.1: New Zealand locations that have reported tsunamis between 1840 and 1982 (from deLange and Healy, 1986).

Sources for tsunamis that have affected New Zealand are distant, regional, and local earthquakes, coastal landslides accompanying earthquakes, spontaneous landslides, submarine landslides (Berryman, 2005) and from atmospheric coupling after a volcanic eruption (deLange and Healy, 1986).

Earthquakes occurring anywhere in the pacific from Chile to the Aleutians can generate tsunamis that could affect New Zealand (Ridgeway, 1984), although the most significant source for distant source tsunamis is South America as was the case in the 1868, 1877, and 1960 tsunamis (deLange and Healy, 1986, Berryman, 2005, deLange and Fraser, 1999, deLange 2003, deLange, 1998). Locations that represent either minimal or no risk to New Zealand are Hawaii, Papua New Guinea, the Solomon Islands, Indonesia, the Philippines, islands of the South Pacific, Japan, the Kurile Islands, Mexico and Kamchatka. This is because they are either unlikely to produce tsunamis or the travel path is indirect and energy to produce a tsunami would dissipate before arrival in New Zealand (deLange, 1998, Berryman, 2005). Sources that pose indeterminate risk to New Zealand are the west coast of North America (deLange, 1998), specifically the Cascadian margin (Berryman, 2005), and the Alaska/Aleutians area (deLange, 2003). In the case of the Cascadian margin, it is believed that the region ruptures with a magnitude 9.0 earthquake at approximately 800 year intervals. With the last Cascadian event occurring in 1700, before New Zealand written records began, it is only possible to estimate the likely affects to New Zealand using numerical modelling, which estimate wave heights of 2-3 meters (Berryman, 2005). Distant source tsunamis have been generated from Alaska and the Aleutians in 1946, 1957, and 1964. These tsunamis, however, do not reflect all possible tsunami sources from this area (Berryman, 2005) nor do they provide enough information to determine tsunami characteristics from this area (deLange, 2003).

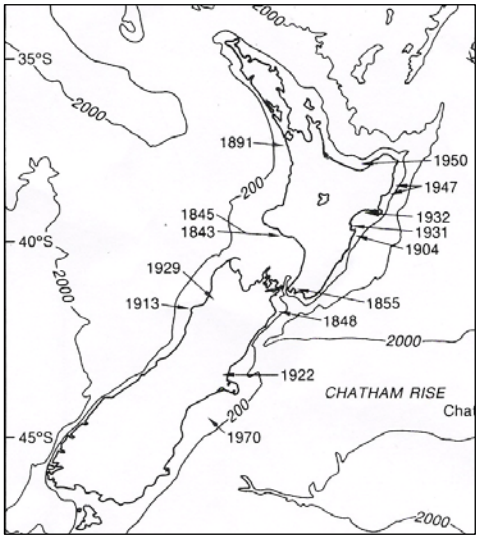


Figure 2.2: Source locations of locally generated tsunamis that have occurred in New Zealand between 1840 and 1982 (from deLange and Healy, 1986).

Regional source tsunamis, which occur with 1-3 hours of warning time, could be generated from earthquakes, landslides, and volcanic eruptions that occur in Tonga, the Kermadecs, Southern New Hebrides, and south of New Zealand (Berryman, 2005).

Approximately 13 (figure 2.2) local sources tsunamis have occurred in the last 100 years, the two most significant of which occurred in 1855 in Wairarapa and in 1947 in Gisborne. With maximum run-ups of 10 meters in both the Wairarapa and Gisborne events and

little warning time, tsunamis from local earthquakes pose a greater risk to a smaller geographical area. Large earthquakes occur regularly in New Zealand because of the large number of faults and the countries location on a plate boundary. Because of that fact and exposure to both coastal and submarine landslides there is no location in New Zealand that is completely free from local source tsunamis (Berryman, 2005).

Some locations in New Zealand are more at risk than others. The majority of tsunamis have been reported from the east coast (figure 2.1) because the main sources for distantly generated tsunamis are to the east of New Zealand (deLange, 2003 and deLange and Healy, 1986), whereas tsunamis coming from the east are obstructed by islands and a shallow sea (deLange, 1998). In addition, Banks Peninsula and Poverty Bay experience amplifying effects. The Chatham rise is though to concentrate energy thus increasing wave heights by 200-300% in the Banks Peninsula area (deLange, 1998).

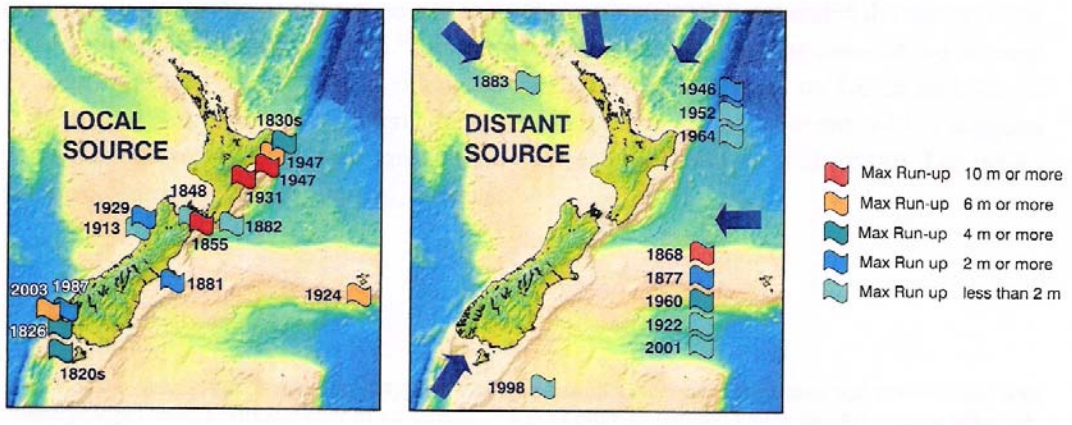


Figure 2.3: Largest historical tsunamis (from Berryman, 2005).

Although damage to New Zealand from tsunamis has not been as devastating as in other locations, such as the 2004 Indian Ocean tsunami or the 1960 tsunami in Hawaii, it has been greater than popular culture makes it out to be. According to Berryman (2005), the largest tsunamis have been from two local earthquakes which occurred at Wairarapa in 1855 and offshore of Gisborne in 1947, and from 3 distant source tsunamis originating from South America in 1868, 1877, and 1960 (figure 2.3). Both the Wairarapa and Gisborne events produced local run-ups of 10 meters while the tsunamis from distant sources have had run-ups varying between 1 to 4 meters (Berryman, 2005). Types of damage that have occurred historically include loss of life and personal injury, structural damage to coastal property, damage to vessels, wharfs and jetties, flooding, and coastal erosion (table 2.2) (deLange and Healy, 1986).

Tsunami event	A	B	C	D	E
1848 Oct. 15				✓	
1855 Jan. 23		✓		✓	
1868 Aug. 13	✓	✓	✓	✓	✓
1877 May 10		✓	✓	✓	✓
1883 Aug. 27			✓		
1913 Feb. 13				✓	
1922 Dec. 25				✓	
1929 June 16		✓		✓	✓
1931 Feb. 2		✓		✓	
1947 Mar. 26		✓	✓	✓	
1947 May 17			✓	✓	
1952 Nov. 4	✓		✓		
1960 May 22		✓	✓	✓	✓
1976 Jan. 14			✓		

Table 2.2: Tsunami damage from historical tsunamis. A) Loss of life or injury, B) Damage to shore base structures (docks, etc.), C) Damage to or loss of floating objects, D) Coastal Flooding, E) Geological (scouring, erosion) (from deLange and Healy 1986).

The hazards to New Zealand from tsunamis is not as great as in other countries, such as Japan and Chile, however, the frequency of historic events indicates that the return period is similar to that of other regions which are considered to have problems with tsunamis, such as Hawaii and Indonesia (Goff and McFadgen, 2003). Tsunamis have happened in the past and can be expected to occur in the future. All of the New Zealand coast is at risk from this hazard (Ridgeway, 1984; Berryman, 2005) and the potential for damage is greater than the historical record indicates.

2.3 The Damage Potential

The worldwide record of tsunami occurrence goes back thousands of years (Lander and Lockridge, 1989; Bryant, 2001) during which time there have been at least 20 tsunamis where the death toll has been greater than five thousand (table 2.3) (Bryant, 2005; Wikipedia, 2006). In the Pacific alone there have been almost 1490 historical tsunamigenic events. Of these at least 295 have caused fatalities (Intergovernmental Oceanic Commission, 1999).

Date		Location	Fatalities
2004	26 Dec	Indian Ocean	229,000
1755	1 Nov	Lisbon, Portugal	100,000
1908		Messina, Italy	70,000
1782	22 May	South China Sea, Taiwan	50,000
1883	7 Aug	Krakatau, Indonesia	36,417
1707	28 Oct	Nankaido, Japan	30,000
1896	15 June	Sanriku, Japan	27,122
1826		Japan	27,000
1498	20 Sept	Nankaido, Japan	26,000
1868	12 Aug	Arica, Chile	25,674
1293	27 May	Sagami Bay, Japan	23,024
1976	4 Feb	Guatemala	22,778
1746	29 Oct	Lima, Peru	18,000
1917	12 Jan	Bali, Indonesia	15,000
1792	21 May	Unzen, Ariake Sea, Japan	14,524
1771	24 Apr	Ryukyu Archipelago	13,486
1815	22 Nov	Bali, Indonesia	10,253
1765	May	Guanzhou, South China Sea	10,000
1976	16 Aug	Moro Gulf, Philippines	8,000
1703		Tokaido-Kashima, Japan	5,233
1605		Nankaido, Japan	5,000

Table 2.3: Worldwide tsunamis with the highest death toll (Bryant, 2001; Bryant, 2005; Wikipedia, 2006).

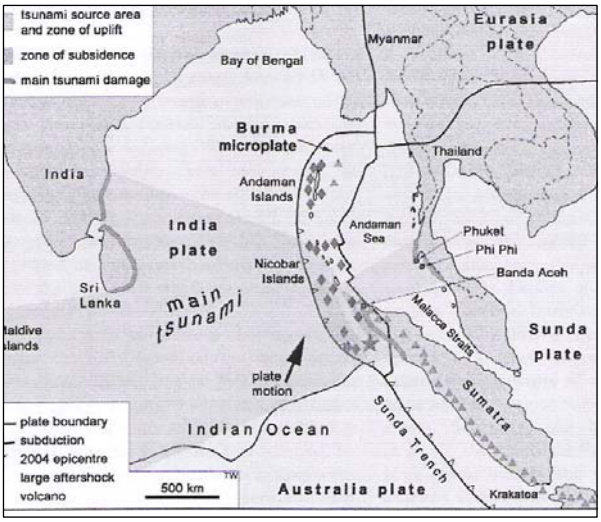


Figure 2.4: Locations most affected by the 2004 Boxing Day tsunami (Waltham, 2005).

By far the most destructive and well known tsunami to date is the 2004 Boxing Day Tsunami, where the death toll was 229,000 (186,983 are confirmed dead, and 42,883 missing) (Wikipedia, 2006). This event was singularly responsible for over 94% of all deaths from natural disasters in 2004 (CRED, 2005). It directly affected at least 16 nations, including Indonesia, Sri Lanka, India, Thailand, the Maldives, Somalia, Myanmar, Malaysia, Seychelles, Bangladesh, South Africa, Yemen, Oman, Tanzania, and Kenya (Synolakis and Kong, 2006; Wikipedia, 2006) and changes in sea level were recorded globally (NGDC, 2006). The most extensive damage occurred in Sumatra, Sri Lanka, India, and Thailand (figure 2.4) where many coastal towns were nearly totally destroyed (figure 2.5) (Waltham, 2005). Indonesia experienced some of the worst damage and the highest wave heights. Wave heights of 20-30 meters were reported from several locations with the highest, 50.9 meters, recorded at Labuhan on the northwest coast of Sumatra (NGDC, 2006).

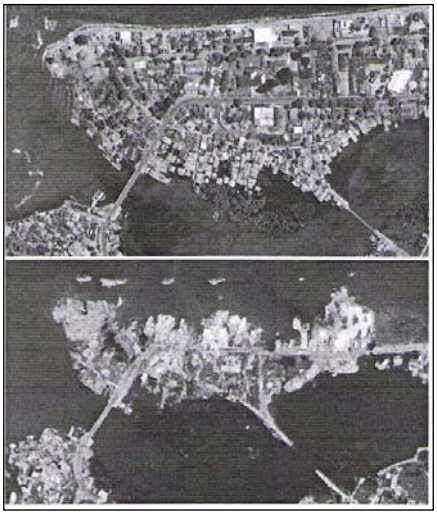


Figure 2.5: Satellite images of the town of Banda Aceh, Sumatra before and after the 2004 Boxing Day tsunami (Waltham, 2004).

Even though none have been quite as devastating, there have been many damaging tsunamis prior the 2004 Boxing Day Tsunami. The most destructive tsunami to affect Indonesia previously was from the eruption of Krakatau in 1883, which had wave heights of up to 30m locally and worldwide impact (Bryant, 2005). The deadliest tsunami in the Atlantic occurred in 1755 in Lisbon, Portugal. The death toll reached approximately 100,000 during the tsunami, although, this was actually the result of the tsunami, earthquake and resulting fires (Wikipedia, 2006). The location that has been affected by the most tsunamis is Japan, where 38 tsunamis over 1m

occur each century (deLange and Fraser, 1999) and an estimated 211,300 deaths have been attributed to tsunamis (Bryant, 2005).

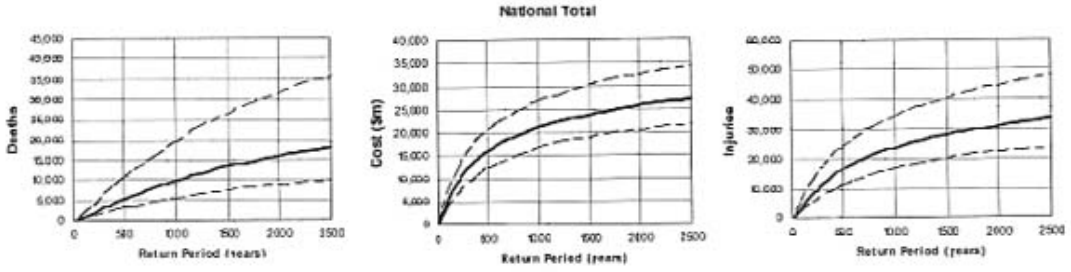


Figure 2.6: National risk curves depicting deaths, injuries and cost (Berryman, 2005).

So the question is could a tsunami cause that kind of death and destruction in New Zealand? In response to the 2004 Boxing Day tsunami the New Zealand Ministry of Civil Defence commissioned two reports to determine just that. These reports are **Review of Tsunami Hazard and Risk in New Zealand,** known as the Science Report (Berryman, 2005) and **Review of New Zealand's preparedness tsunami hazard, comparison to risk and recommendations for treatment**, known as the Preparedness Report (Webb, 2005). The Science Report deals with a New Zealand's vulnerability to tsunamis and provides a probabilistic hazard assessment including casualty, injury, and cost estimates for major coastal urban areas and for the nation as a whole (figure 2.6). Since a distant tsunami could affect more than one location the national totals are aggregated for individual events and take into account the relative tides. According to this report New Zealand would not suffer such devastation. For a 500 year return period (probability of 1 in 500 of occurring in any given year) median estimated deaths for the ten largest urban centres would total approximately 5,500, though, this is most likely an overestimate because it assumes no warning and occurrence at night when most people would be at home (Berryman, 2005). Estimated wave heights would also be less than what has been experienced globally during catastrophic tsunamis. The greatest wave heights are expected to occur in the Chatham Islands, Gisborne, Wellington, and Canterbury and do not exceed 14m for a 2500 year return period (figure 2.7) (Berryman, 2005).

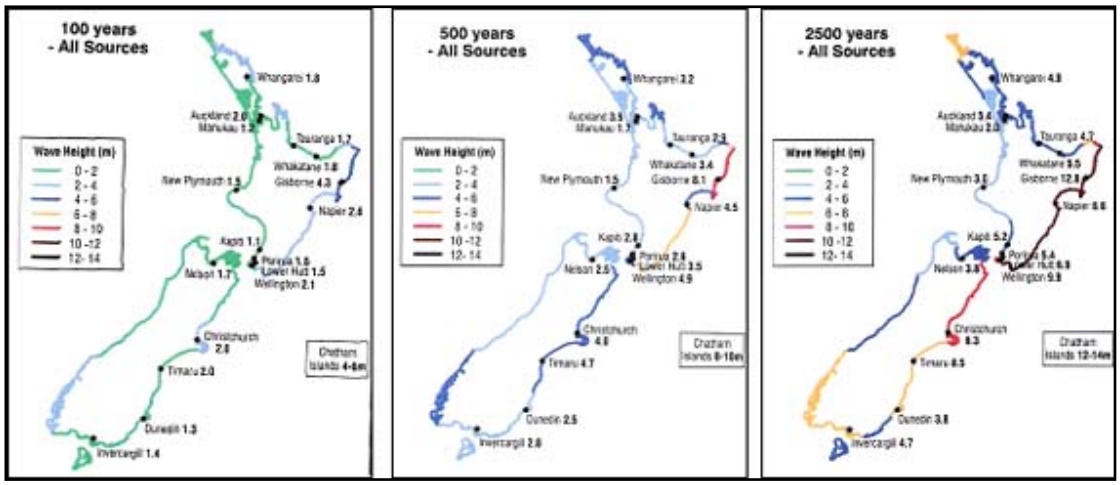


Figure 2.7: Mean estimated wave heights for New Zealand for all tsunami sources (Berryman, 2005).

These projected casualty figures are still greater than what has been experienced in New Zealand to date and there are a few reasons why tsunamis have had that great an impact.

Tsunami date		Location	Population then*	Population now
1855	23 Jan.	All New Zealand	37,192	4,027,947
		Wellington	8,124	448,959
1868	13 Aug.	All New Zealand	227,810	4,027,947
		Auckland	48,321	1,303,068
		Wellington	21,950	448,959
		Hawkes Bay	5,283	147,783
		Canterbury	38,448	521,832
		Otago	48,577	193,800
		Chatham Islands	184	618
1877	10 May	All New Zealand	417,622	4,027,947
		Hawkes Bay	14,951	147,783
		Canterbury	89,268	521,832
1947	25 Mar.	All New Zealand	1,817,500	4,027,947
		Gisborne	37,769	44,499
1960	22 May	All New Zealand	2,403,600	4,027,947
		Northland	86,391	148,470
		Auckland	514,507	1,303,068
		Bay of Plenty	349,624	257,379
		Gisborne	45,478	44,499
		Hawkes Bay	114,470	147,783
		Wellington	473,541	448,959
		Canterbury	344,597	521,832
		Otago	176,325	193,800

Table 2.4: Populations of locations that have been affected by tsunami events; then and now. * Population is exclusive of Maori until 1960 (New Zealand Census).

One of the reasons that tsunamis have not been as damaging as they have the potential to be is that the population of New Zealand was significantly smaller in the past and has increased greatly since its establishment. During all of the significant tsunamis that have affected New Zealand the population was at least half of what it is currently (table 2.4). In addition, a major tsunami has not occurred since the period of coastal development that began in the 1960s and 70s (deLange and Healy, 1986).

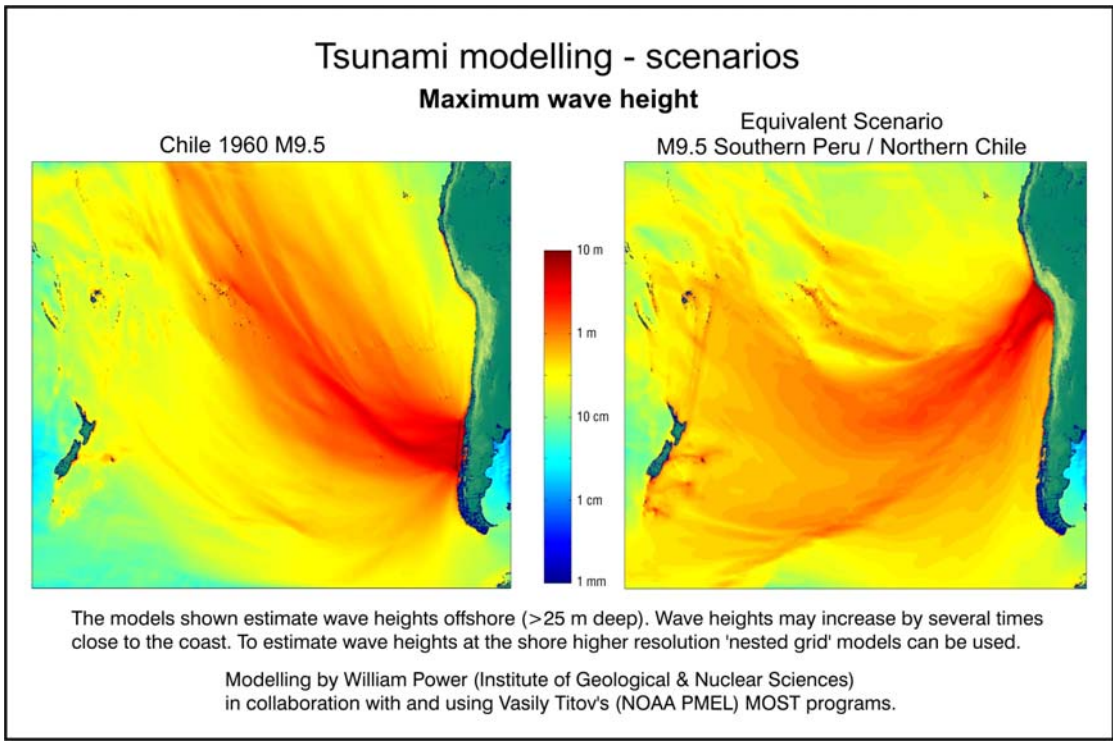


Figure 2.8: Direction in which energy traveled from the 1960 and 1868 tsunamis (Berryman, 2005).

Another reason that tsunamis have not been as devastating is that several of the more noteworthy have occurred at or near low tide, including the 1868, 1877 and 1960 tsunamis (Berryman, 2005). This has reduced the wave heights by as much as a meter in some cases.

Also tsunamis have not been as damaging as they have the potential to be is that in the past tsunami energy has not been directed as efficiently as possible towards New Zealand (figure 2.8). The 1960 tsunami was caused by a magnitude 9.4-9.5 earthquake whereas the 1868 tsunami was generated by a magnitude 9.1 earthquake. The location that the 1868 tsunami was generated from more efficiently directed the tsunami waves towards New Zealand than that of the 1960 tsunami. If a larger magnitude earthquake were to occur at that location, which is possible as evinced by the 1960 event, a much larger tsunami could occur in New Zealand (Berryman, 2005).

Tsunamis have affected New Zealand over 40 times during the historical period and with potentially more devastating affects in the future it is important to invest in mitigation effort.

2.4 Hazard Mitigation

In response to the 1946 Alaskan tsunami the United States established a tsunami warning centre for the Pacific Ocean. Initially set up to issue warnings to the United States and Hawaii, the Pacific Tsunami Warning Center (PTWC) was expanded to include all Pacific countries after the 1960 Chilean tsunami (Bryant, 2005). PTWC issues warning/watches depending on the location and magnitude of earthquakes. Locations within three hours travel time of the epicentre are issued tsunami warnings and areas within three to six hours are put on tsunami watch status (Finnimore, 1999). For earthquakes with a Richter magnitude of 7.5 or greater warnings/watches are issued to local, state, national, and international centres (Bryant, 2005; Webb, 2005).

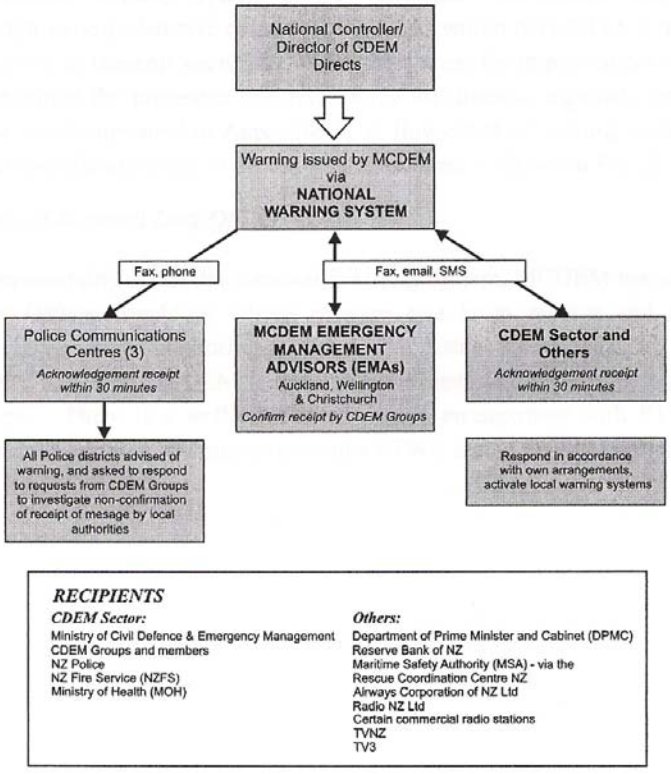


Figure 2.9: Flowchart of the operational procedures of the National Warning System (from Webb, 2005).

New Zealand became a member of the PTWC in 1965 and the designated recipient for communications from PTWC is the Ministry of Civil Defence and Emergency Management (MCDEM) along with MetService and Airways Corporation, to guarantee receipt (Webb, 2005). MCDEM used the National Warning System to distribute national warning messages (figure 2.9). When a tsunami watch/warning is received by MCDEM information is relayed to Regional Councils, local Civil Defence and Emergency Management Groups, territorial authorities, the Police and New Zealand Defence Force and other organizations responsible for hazard mitigation (deLange and Fraser, 1999). It is then the responsibility of local

Civil Defence and Emergency Management Groups to respond to warnings and issue further warnings and evacuations as they deem necessary (Webb, 2005).

Although the National Warning System is tested quarterly, with 90% of recipients receiving warnings within 15 minutes (Finnimore, 1999), no distant source tsunami has affected New Zealand since it joined the PTWC so it has yet to be seen how effective the system really is (Bryant, 2005).

Since distant source tsunamis have a relatively long lead time for warnings (~14 hours for tsunamis from South America), warning systems have time to distribute messages and evacuate people, however, for local source tsunamis time is not available. It is therefore extremely important to educate the public as a method of hazard mitigation (Webb, 2005).

Also early warning systems are only part of an effective mitigation strategy (Webb, 2005). Reactions of individuals to warning messages determine the overall effectiveness of mitigation measures. People's knowledge and perception of the hazard and of the warning system play a great role in how they will react.

Chapter 3
Non-resident Survey

3.1 Introduction

With a death toll of over 226,000 (Wikipedia, 2006; CRED, 2005), the Indian Ocean Tsunami of 2004 brought the realization of just how devastating a tsunami could be. This prompted the Ministry of Civil Defence to commission two reports from Geological and Nuclear Sciences (GNS) to determine the level of preparedness and the current state of knowledge on tsunamis for New Zealand (Webb, 2005). These reports are the Science Report (Berryman, 2005) and the Preparedness Report (Webb, 2005). The scope of the reports, however, was limited due to time restrictions and did not address the issue of non-resident summer populations and tourism concerns (Berryman, 2005).

Summer populations are considerably higher than that of other seasons due to the influx of visitors. Coastal holiday parks, which are an integral part of the New Zealand tourism industry, place an increased proportion of the population in the hazard zone. Tourists can be more vulnerable to hazards due to their unfamiliarity with possible local disasters (Faulkner and Vikulov, 2001), warning systems, and evacuation procedures. Surveying was undertaken during the peak summer months to ascertain tourist perceptions and knowledge of the tsunami hazard.

3.2 Methodology

Interview style surveying was conducted at eleven locations in the coastal Christchurch and Banks Peninsula area of the Canterbury Region including; Akaroa Top Ten Holiday Park, the township of Akaroa, Duvauchelles, Kairaki

Location	Altitude (m)	Distance to shore (km)	Maximum occupancy
Akaroa Top Ten	150	0.15	387
Duvauchelles	5	0.05	460
Kairaki Beach	3	0.2	300
Little Akaloa	11	0.2	125
Okains Bay	2	0.1	600
Pigeon Bay	5	0.1	125
Purau Bay	5	0.2	750
South Brighton	2	0.5	400
Spencer Beach	5	0.2	1400
Wood end	3	0.3	500

Table 3.1: Locations in which survey was conducted. Tumonz Data (Tumonz, 2006) was use for elevations and altitude. Sight occupancy information was received from staff at each location.

Beach Camping Ground, Little Akaloa, Okains Bay, Pigeon Bay, Purau Bay Holiday Park, South Brighton Motor Camp, Spencer Beach Holiday Park, and Wood end Beach Holiday Park (table 3.1, figure 3.1). All locations, except Akaroa Top Ten are located in the likely tsunami inundation zone, which is 1 km from the shore and under 35m in elevation.

A total of 211 interviews were conducted between December 23rd, 2005 and January 31st, 2006, during the peak holiday occupancy period. The survey questions were based on the National Coastal Survey conducted by Geological and Nuclear Sciences (GNS) in 2003 (Johnston *et al,* 2003). The questionnaire was composed of scaled, open, and closed ended questions and the main themes included:

Knowledge of risk: This included questions on the likely hazards for the area, when the last tsunamis occurred, and when the participant believed a future tsunami could occur.

Preparation and warnings: Visitors were asked a range of questions about where tsunamis originated, whether they had heard, received, or sought information about tsunamis, who issued tsunamis warnings, what some natural signs of tsunamis were, and what the components of the tsunami warning system are.

During a tsunami: Participants answered on what they would do during both a local and distant source tsunami, how much time they would have to move to safety, and what they would expect from the holiday park staff/owners in the event of a tsunami.

Changes since the 2004 Boxing Day tsunamis: Participants were asked whether they knew what a tsunami was prior to the Boxing Day tsunami of 2004 and how they had been affected from the tsunami.

Survey data was analysed with SPSS statistical software. In order to simplify the results, answers to open ended questions were categorized and have been reported by those categories. The full answers and any answers reported in the "other" category are located in Appendix 3.

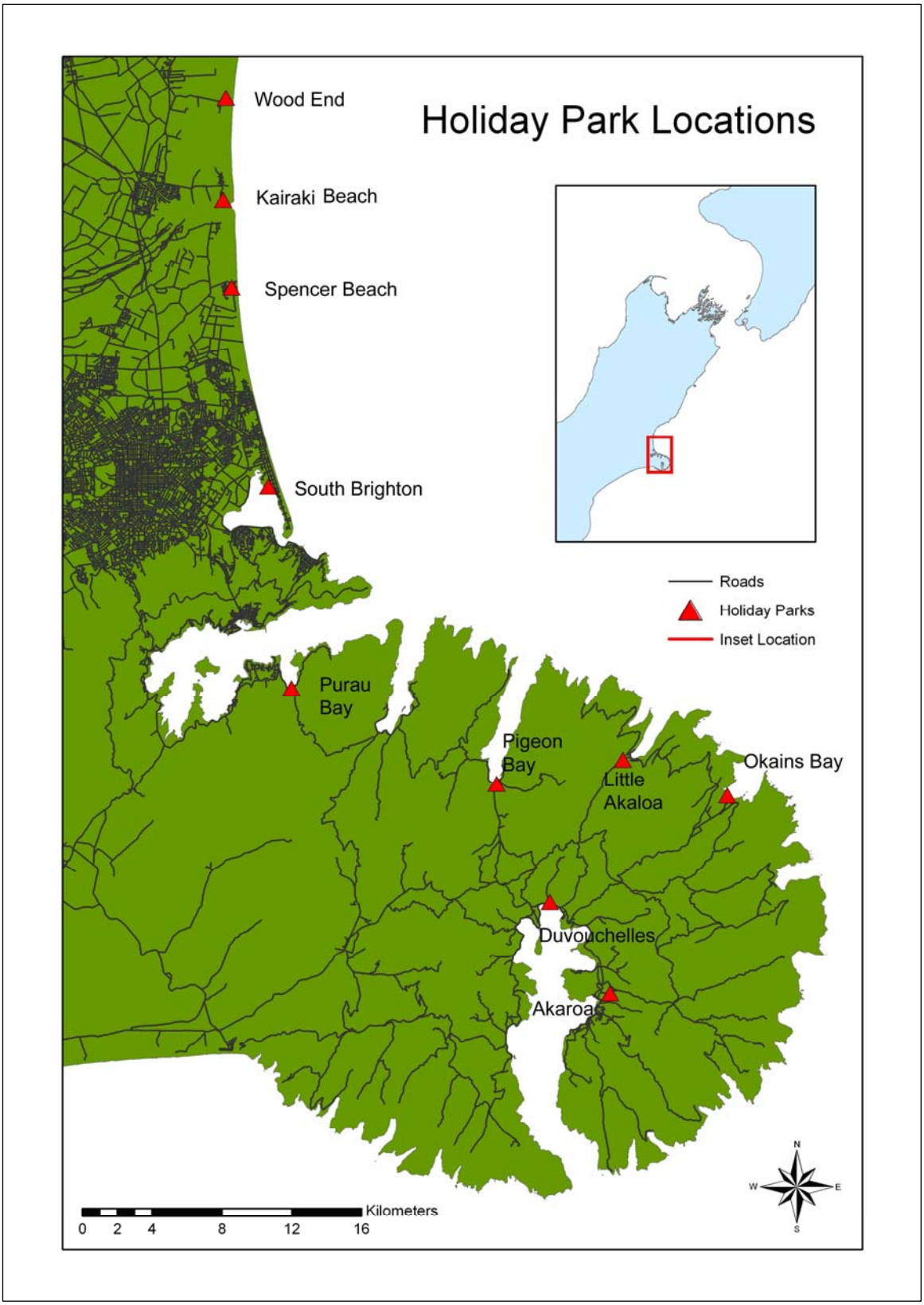


Figure 3.1: Map of survey locations.

3.3 Results

1	**Are you an overnight camping visitor, camping visitor for an extended period (camping for more than 2 weeks), a day visitor, or an employee?**	
total n= 211	*n*	%
Camping Visitor	149	70.6
Extended Camping Visitor	35	16.6
Day Visitor	14	6.6
Permanent Resident	7	3.3
Employee	6	2.8

3.3.1 Personal Information

The highest percentage of participants was camping visitors whose stays were less than two weeks in length.

2	**How many days per year on average do you visit?**	
	average	**standard deviation**
Camping Visitor	5.7	3.3
Extended Camping Visitor	35.1	44.0
Day Visitor	1	-
Permanent Resident	365	-
Employee	-	-
All visitors	22.32	65.5

Average number of days per year was greater for campers who were staying for an extended period although the mean average, 35.1 days, was two times higher than the median, which was only 15 days. This was from a few individuals who spent the entire summer season or several months of the year at the holiday park.

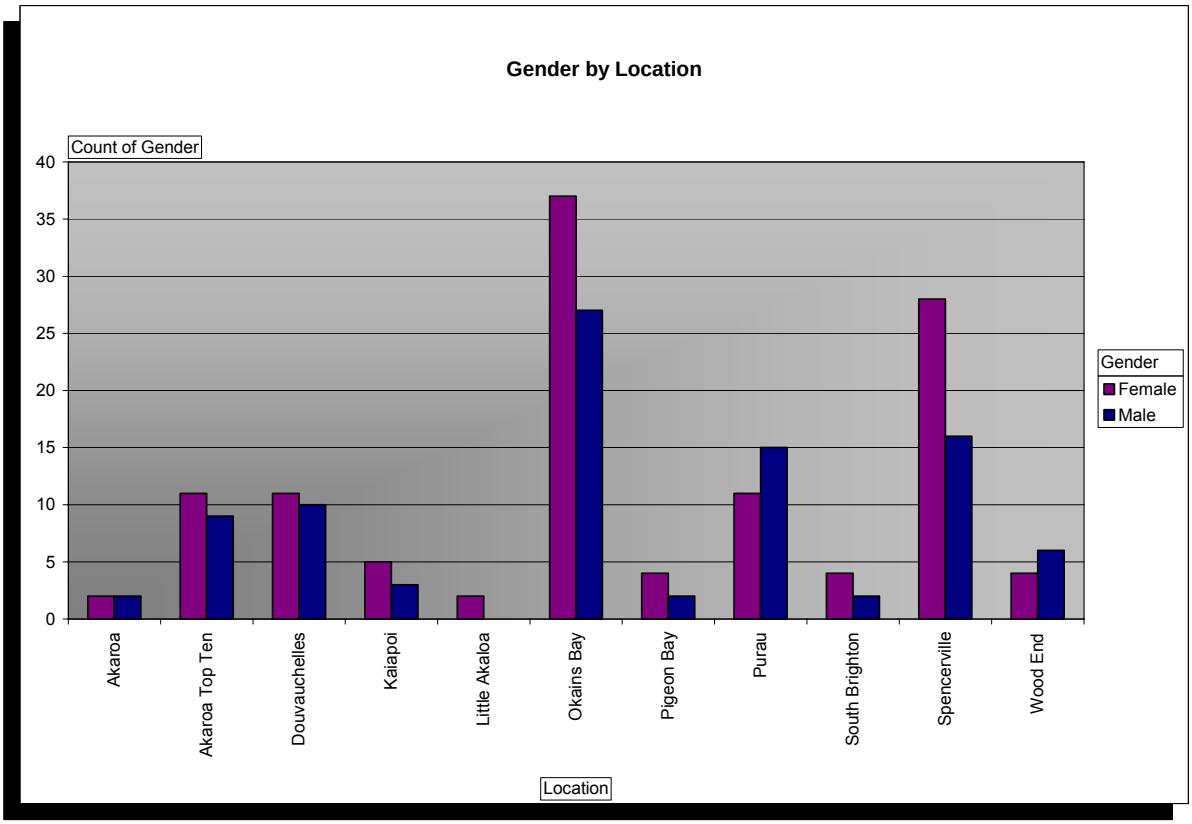
3	How many years have you been visiting? (avg.)	
	average	**standard deviation**
Camping visitors	8.20	10.7
Extended camping visitors	11	9.7
Day visitors	-	-
Permanent resident	3.83	2.5
Employee	-	-
All	8.14	10.6

There was no significant variation between camping visitors, extended stay campers, and permanent residents in numbers of years visiting the location.

4	Are you from the Canterbury Region, New Zealand, or abroad?	
total n= 211	*n*	%
Canterbury Region	195	92.4
New Zealand	11	5.2
Abroad	5	2.4

By far the highest percentage of respondents was from the Canterbury region. This is not surprising since the majority of participants were on holiday for less than two weeks.

5	Male or Female	
total n= 211	*n*	%
Male	92	43.6
Female	119	56.4

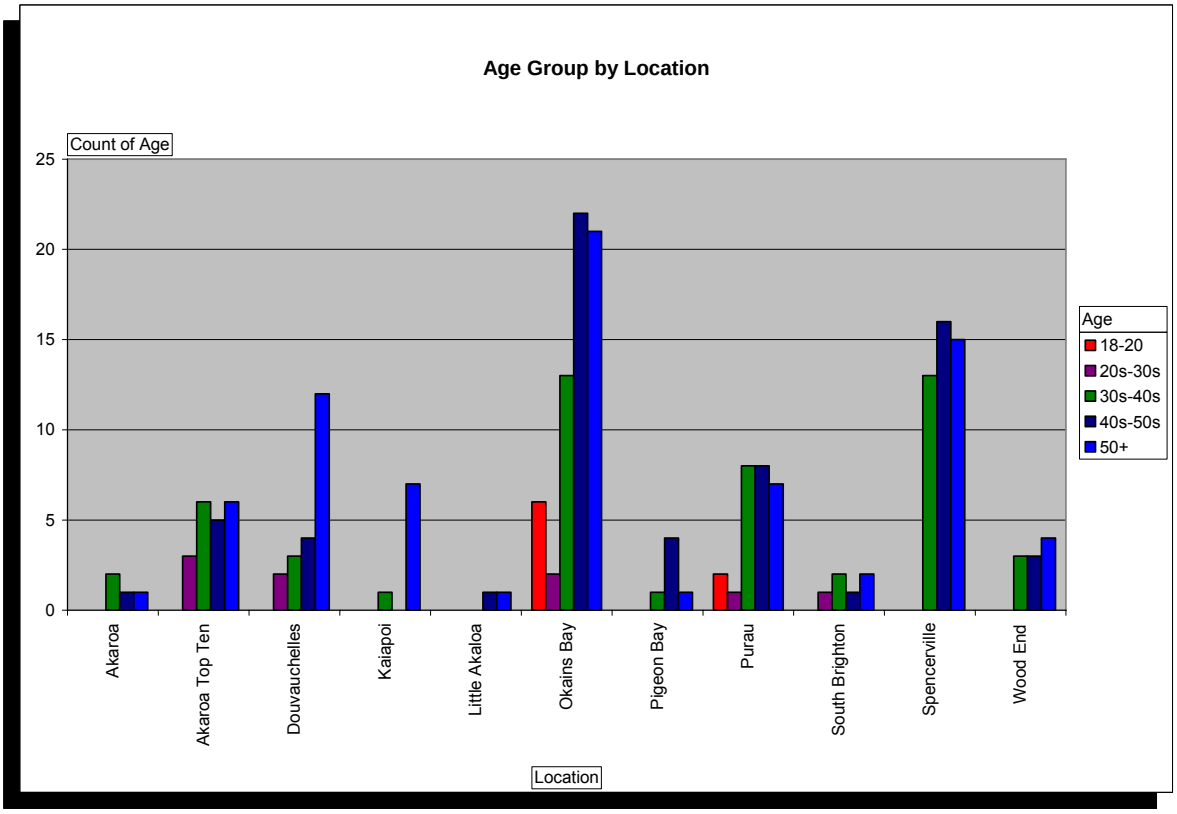


Gender by Location			
	Female	Male	**Total**
Akaroa	2	2	**4**
Akaroa Top Ten	11	9	**20**
Duvauchelles	11	10	**21**
Kairaki	5	3	**8**
Little Akaloa	2	0	**2**
Okains Bay	37	27	**64**
Pigeons Bay	4	2	**6**
Purau	11	15	**26**
South Brighton	4	2	**6**
Spencerville	28	16	**44**
Wood end	4	6	**10**
Total	**119**	**92**	**211**

Gender distribution was nearly even, with 43.6% of respondents being male and 56.40% being female. At most sites a nearly equal number of males and females

were surveyed, with the exceptions of Okains Bay and Spencerville Beach Park, were far more females were interviewed.

6	**Age Group**	
total n= 211	***n***	**%**
18-20	8	3.8
20s-30s	10	4.7
30s-40s	51	24.2
40s-50s	65	30.8
50s-60s	77	36.5



Age Group by Location						
	18-20	**20s-30s**	**30s-40s**	**40s-50s**	**50+**	**Total**
Akaroa	0	0	2	1	1	**4**
Akaroa Top Ten	0	3	6	5	6	**20**
Duvauchelles	0	2	3	4	12	**21**
Kairaki	0	0	1	0	7	**8**
Little Akaloa	0	0	0	1	1	**2**
Okains Bay	6	2	13	22	21	**64**
Pigeons Bay	0	0	1	4	1	**6**
Purau	2	1	8	8	7	**26**
South Brighton	0	1	2	1	2	**6**
Spencerville	0	0	13	15	16	**44**
Wood End	0	0	3	3	4	**10**
Total	**8**	**9**	**52**	**65**	**77**	**211**

Over two thirds of respondent were over 40 years of age. This may reflect the time of day in which surveying was done, between 9 am and 5 pm, when many of the people visiting campgrounds, especially the younger ones, are away doing other activities. This also may be due to the familial nature of the camping excursion, with many of the participants having children too young to participate in the survey. More persons between the ages of 18 to 30 were present during New Years Eve (when all of the campsites were at maximum capacity), however, most declined to participate.

7	**How much time do you spend in the near shore environment?**	
total n= 211	*n*	%
At least some time	23	10.9
One a week	12	5.7
Daily	162	76.8
None	14	6.7

8	**What activities do you engage in while at the coast?**	
total n= 211	*n*	%
Swimming	106	50.2
Fishing	50	23.7
Boating	53	25.1
Time with kids	13	6.1
Walking	66	31.7
Biking	22	10.4
Relaxing	12	5.7
Organized Tour	6	2.8
Other	16	7.6

The predominant activities were swimming, fishing, boating, and walking along the beach. Most participants spent their time engaged in informal activities rather than organized tours and those that did were almost exclusively from Akaroa Top Ten Holiday Park. This is most likely due to the fact that this holiday park is located in the largest town, which provides more touring opportunities.

9	Have you had any previous personal experience with a tsunami?	
total n= 211	***n***	**%**
Yes	16	7.6
No	195	92.4

Since the last tsunami that affected the Bank Peninsula region was in 1960 the majority of participants had not personally experienced a tsunami, although over a third were old enough to have done so. Those that reported yes usually indicated participation in an evacuation from a school, although a couple indicated going to the waterfront to watch the tsunami's arrival. Many respondents seemed to equate personal experience with a tsunami to mean personal experience with a devastating tsunami.

3.3.2 Knowledge of Risk

10	What do you believe the likely natural hazards to affect this area are?	
total n= 211	***n***	**%**
None	3	1.4
Landslide	5	2.4
Earthquake	51	24.2
Tsunami	62	29.4
Wildfire	74	35.1
Flooding	36	17.1
Volcano	4	1.9
Coastal Erosion	3	1.4
Other- wind	36	17.1
Other- trees falling	37	17.5
Other	102	48.4

11	How likely do you think it is that the following natural hazards could affect this area? 1- definitely not – 5 – definitely affect										
total n=211		***n***					**%**				
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	2.1	102	37	35	11	25	48.3	17.5	16.6	5.2	11.9
Earthquake	3.4	11	22	72	50	50	5.2	10.4	34.1	23.7	23.7
Tsunami	2.8	41	47	49	34	34	19.4	22.3	23.2	16.1	16.1
Wildfire	3.8	12	14	32	63	84	5.7	6.7	15.2	29.9	39.8
Flooding	2.9	37	46	48	36	38	17.6	21.8	22.8	17.1	18.0
Volcano	1.2	170	24	4	3	4	80.6	11.4	1.9	1.4	1.9
Coastal Erosion	3.1	39	43	34	27	62	18.5	20.4	16.1	12.8	29.4
No Hazards		5					2.4				

For the Canterbury region, the hazards that were believed to be the most predominant were earthquakes and wildfires, with tsunamis, landslides, and flooding believed to be of moderate threat and volcanoes though to be not a problem. Most people were aware that Banks Peninsula was of volcanic origin but was extinct. The perceived hazards varied for individual campsite locations.

11	**Akaroa**										
total n = 4		***n***					**%**				
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	1.8	2	1	1	0	0	50	25	25	0	0
Earthquake	2.0	2	0	2	0	0	50	0	50	0	0
Tsunami	1.0	4	0	0	0	0	100	0	0	0	0
Wildfire	2.5	1	1	1	1	0	0	0	0	0	0
Flooding	2.0	1	2	1	0	0	25	50	25	0	0
Volcano	1.3	3	1	0	0	0	75	25	0	0	0
Coastal Erosion	1.8	1	3	0	0	0	25	75	0	0	0
No Hazards		0					0				

Figure 3.2: Town of Akaroa waterfront area (ECAN, 2006).

All hazards were perceived to be of low risk to the township, especially tsunamis. Participants noted that it would be unlikely for a tsunami to travel into the harbour. The highest recognized natural hazards were earthquake and flooding.

11	**Akaroa Top Ten**										
total n = 20		***n***					**%**				
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	3.1	2	2	11	2	3	10	10	55	10	15
Earthquake	3.7	0	2	8	4	6	0	10	40	20	30
Tsunami	2.0	9	5	4	1	1	45	25	20	5	5
Wildfire	3.2	2	4	3	6	4	10	20	15	30	20
Flooding	2.6	5	6	4	3	2	25	30	20	15	10
Volcano	1.7	14	3	0	1	2	70	15	0	5	10
Coastal Erosion	3.4	1	5	4	5	5	5	25	20	25	25
No Hazards		0					0				

Figure 3.3: Akaroa Top Ten Holiday Park (ECAN, 2006).

The greatest perceived natural hazards at this location were from earthquakes and coastal erosion and the lowest were from volcanoes and tsunamis. Akaroa Top Ten Holiday Park is located on a hill approximately 150 meters above sea level, which limits the likelihood of tsunamis to extreme events such as those caused by bolide impact or very large landslides.

11	**Duvauchelles**										
total n = 21		***n***					**%**				
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	1.8	7	8	2	1	1	33.3	38.1	9.5	4.8	4.8
Earthquake	3.4	1	2	5	4	7	4.8	9.5	23.8	19.0	33.3
Tsunami	2.1	7	7	2	3	1	33.3	33.3	9.5	14.3	4.8
Wildfire	3.1	2	2	5	5	5	9.5	9.5	23.8	23.8	23.8
Flooding	2.8	4	3	4	3	5	19.0	14.3	19.0	14.3	23.8
Volcano	1.2	16	2	0	0	1	76.2	9.5	0.0	0.0	4.8
Coastal Erosion	3.2	3	2	5	0	9	14.3	9.5	23.8	0.0	42.9
No Hazards		1					4.8				

People recognized that volcanoes were improbable, but landslides were also indicated to be unlikely, though the hilly nature of the peninsula makes landslides a feasible hazard. Earthquake was indicated as the highest possible event. Tsunamis were though to be of minor consideration, which is reasonable since the site is located far inside the harbour and not directly exposed to the open ocean.

Figure 3.4: Duvauchelles Holiday Park (ECAN, 2006).

11	Kairaki										
total n =8			***n***					**%**			
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	1.0	8	0	0	0	0	100	0.0	0.0	0.0	0.0
Earthquake	2.5	2	2	3	0	1	25	25	37.5	0.0	12.5
Tsunami	3.1	1	2	1	3	1	12.5	25	12.5	32.5	12.5
Wildfire	4.8	0	0	1	0	7	0.0	0.0	12.5	0.0	87.5
Flooding	3.4	1	2	1	1	3	12.5	25	12.5	12.5	37.5
Volcano	1.0	8	0	0	0	0	100	0.0	0.0	0.0	0.0
Coastal Erosion	2.50	4	0	1	2	1	50	0.0	12.5	25	12.5
No Hazards		0					0.0				

It was indicated that volcanoes and landslides are the least likely hazard at this location and since the area is flat and not located near any active volcanoes this is a reasonable response. Wildfire was believed to be the most expected event, which is most likely due to the fact that several destructive wildfires had already occurred in the area. Tsunamis and flooding were also though to be of moderate threat.

Figure 3.5: Kairaki Beach Holiday Park (ECAN, 2006).

11	Little Akaloa										
total n = 2			***n***					**%**			
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	4.0	0	0	1	0	1	0.0	0.0	50	0.0	50
Earthquake	2.0	0	0	2	0	0	0.0	0.0	100	0.0	0.0
Tsunami	2.5	0	1	1	0	0	0.0	50	50	0.0	0.0
Wildfire	2.5	0	1	1	0	0	0.0	50	50	0.0	0.0
Flooding	3.5	0	0	1	1	0	0.0	0.0	50	50	0.0
Volcano	1.0	1	0	0	0	0	50	50	0.0	0.0	0.0
Coastal Erosion	4.0	0	0	0	2	0	0.0	0.0	0.0	100	0.0
No Hazards		0					0.00				

Figure 3.6: Little Akaloa campground (ECAN, 2006).

This campsite was occupied primarily in the period between Christmas and New Years. Being a very small campsite there were only a few people available to survey. The perceived hazards, therefore, only reflects the opinions of two people and may not be accurate. The highest perceived hazard was landslide and coastal erosion. Landslides are highly likely since the campsite is located in a narrow valley. Tsunamis were thought to be of minor importance probably because the campsite is not located within direct viewing of the ocean, though a tsunami could easily travel the distance to the site.

11	**Okains Bay**										
total n = 64		***n***					**%**				
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	2.1	26	17	8	7	5	40.6	26.6	12.5	10.9	7.8
Earthquake	3.4	2	8	23	20	10	3.1	12.5	35.9	31.3	15.6
Tsunami	3.0	8	17	13	13	12	12.5	26.6	20.3	30.3	18.8
Wildfire	4.0	3	2	6	31	21	4.7	3.1	9.4	48.4	32.8
Flooding	3.7	9	5	30	17	12	14.1	7.8	46.9	26.6	18.8
Volcano	1.3	52	6	3	1	1	81.3	9.4	4.7	1.6	1.6
Coastal Erosion	3.0	12	18	8	7	18	18.8	28.1	12.5	10.9	28.1
No Hazards		1					1.6				

Wildfire and flooding were though to be the most significant threat at this location. There had been minor flooding of tent sites located along the estuary and several wildfires in the Canterbury Region at the time of surveying. Earthquake and tsunamis were considered a moderate problem.

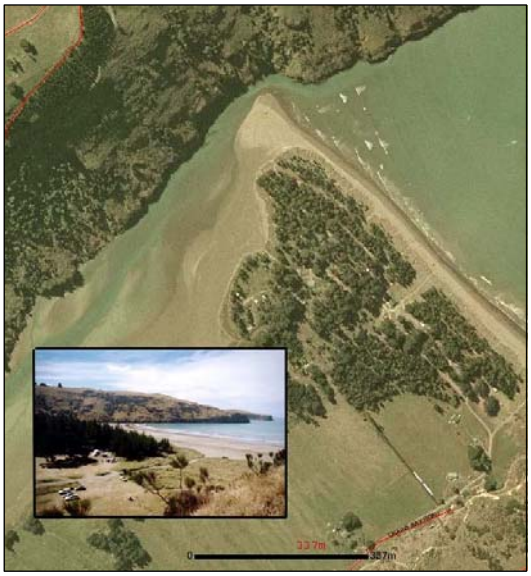


Figure 3.7: Okains Bay Forest Reserve (ECAN, 2006).

11	Pigeon Bay										
total n = 6		***n***					***%***				
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	3.0	2	0	3	1	0	33.3	0.0	50	16.7	0.0
Earthquake	4.3	0	1	0	1	4	0.0	16.7	0.0	16.7	66.7
Tsunami	3.0	1	1	2	1	1	16.7	16.7	33.3	16.7	16.7
Wildfire	3.2	1	2	0	1	2	16.7	33.3	0.0	16.7	33.3
Flooding	2.7	1	2	2	0	1	16.7	33.3	33.3	0.0	16.7
Volcano	1.0	5	1	0	0	0	83.3	16.7	0.0	0.0	0.0
Coastal Erosion	4.0	1	0	0	2	3	16.7	0.0	0.0	33.3	50
No Hazards		0					0.00				

Figure 3.8: Pigeon Bay Holiday Park (ECAN, 2006).

Earthquakes and coastal erosion were perceived to be the greatest risk to this area. A portion of the campground is located on a spit, which would definitely be susceptible to erosive forces and would be cause noticeable changes from year to year. All other hazards, except volcanic, were believed to effect the area moderately.

11	Purau Bay										
total n = 26		***n***					***%***				
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	2.5	6	2	7	0	7	23.1	7.7	26.9	0.0	26.9
Earthquake	3.4	0	3	9	6	6	0.0	11.5	34.6	23.1	23.1
Tsunami	2.9	4	4	6	4	6	15.4	15.4	23.1	15.4	23.1
Wildfire	3.3	0	1	7	7	7	0.0	3.9	26.9	26.9	26.9
Flooding	2.7	3	9	5	2	5	11.5	34.6	19.2	7.69	19.2
Volcano	1.2	17	6	1	0	0	65.4	23.1	3.85	0.0	0.0
Coastal Erosion	3.0	2	5	8	2	7	7.7	19.2	30.8	7.69	26.9
No Hazards		2					7.7				

Most hazards, except volcanic, were deemed to be of moderate consequence at this location. The campsite is located in an area that has been previously affected by tsunamis and is located in an area prone to rock falls.

Figure 3.9: Purau Bay Holiday Park (ECAN, 2006).

11	South Brighton										
total n = 6		***n***					***%***				
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	1.3	4	2	0	0	0	15.4	33.3	0.0	0.0	0.0
Earthquake	3.67	0	1	2	1	2	0.0	16.7	33.3	16.7	16.7
Tsunami	3.67	2	0	2	1	1	33.	0.0	33.3	16.7	16.7
Wildfire	3.3	1	0	2	2	1	16.7	0.0	33.3	33.3	16.7
Flooding	3.5	1	0	2	1	2	16.7	0.0	33.3	0.0	33.3
Volcano	1.5	5	0	0	1	0	83.3	0.0	0.0	16.7	0.0
Coastal Erosion	3.3	1	1	1	1	2	16.7	16.7	16.7	16.7	33.3
No Hazards		0					0.00				

Figure 3.10: South Brighton Motor Camp (ECAN, 2006)

Participants at this location believed tsunamis and earthquakes were the most severe hazard. Earthquakes are a prominent hazard in the Canterbury Region. Participants could be more aware at this location because risk from a tsunami would come from both the open ocean and the estuary and the fact that the spit is relatively flat with limited egress.

11	Spencer Beach										
total n = 44		***n***					***%***				
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	1.2	37	5	2	0	0	84.1	11.4	4.5	0.0	0.0
Earthquake	3.5	4	2	16	11	11	9.1	4.5	36.4	25	25
Tsunami	3.2	4	8	16	6	10	9.1	18.2	36.4	13.6	22.7
Wildfire	4.4	2	1	3	8	30	4.5	2.3	6.8	18.2	68.2
Flooding	2.7	10	14	6	7	7	22.7	31.8	13.6	15.9	15.9
Volcano	1.1	40	4	0	0	0	90.9	9.09	0.0	0.0	0.0
Coastal Erosion	2.9	12	8	7	5	12	27.3	18.2	15.9	11.4	27.3
No Hazards		0					0.0				

Wildfire was clearly the biggest concern at the Spencerville location. This is not surprising since the campground was nearly evacuated from a bush fire during the survey period. Tsunamis were perceived to be a higher risk than at many other locations. This is remarkable since this is one of the few locations where the ocean was not visible from the campsite.

Figure 3.11: Spencer Beach Holiday Park (ECAN 2006).

11	**Wood end**										
total n = 10		***n***					**%**				
	avg.	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Landslide	1.3	8	0	0	0	1	80	0.0	0.0	0.0	10
Earthquake	3.5	0	1	2	3	3	0.0	10	20	30	30
Tsunami	2.9	1	2	2	2	2	10	20	20	20	20
Wildfire	3.9	0	0	2	2	5	0.0	0.0	20	20	50
Flooding	2.3	2	3	2	1	1	20	30	20	10	10
Volcano	1.4	9	0	0	0	0	90	0.0	0.0	0.0	0.0
Coastal Erosion	3.3	2	1	0	1	5	20	10	0.0	10	50
No Hazards		1					10				

Figure 3.12: Wood end Holiday Park (ECAN, 2006).

Again, wildfire was a major concern for this area due to the large number of wildfires that occurred on the Canterbury plains during the summer season. Coastal erosion and earthquake were the next greatest concern. Tsunamis and flooding were of moderate concern.

12	When was the last tsunami that caused damage in Banks Peninsula?	
total n= 211	***n***	**%**
Never	15	7.1
Within the last year	0	0
In the last 1-10 years	6	2.8
In the last 10-100 years	66	31.3
In the last 100-1000 years	5	2.4
Don't know	119	56.4

The last tsunami that caused damage to Banks Peninsula was the 1960 Chilean tsunami (see Chapter 2). Over half of the respondents did not know and about a third was aware of approximately when the last tsunami had occurred.

13	Do you think that a tsunami could occur:	
	n	**%**
While you are visiting	6	2.8
Within the year	5	2.4
In the next 1-10 years	65	30.8
In the next 10-100 years	101	47.9
Not within 100 years	6	2.8
Never	4	1.9
Don't know	24	11.4

The majority of participants though that a tsunami was likely and would occur within 10-100 years, with 1-10 years coming in close second. Most, however, did not believe that a tsunami would occur imminently.

14a	Have you actively sought information about tsunamis from any of the following sources about this area?	
total n= 211	***n***	**%**
Friends or Family	2	1.0
Central Government	0	0.0
Civil Defence	2	1.0
Local Council	0	0.0
Region Council	0	0.0
Business Establishment	0	0.0
Child's School	0	0.0
Research Organization	0	0.0
Other	0	0.0

A very small percentage, 2%, of participants indicated that they had actively sought information on tsunamis with sources being equally from formal and informal sources.

14b	**Have you heard or received information about tsunamis from any of the following sources?**	
total n= 211	***n***	**%**
Friends or Family	37	17.5
Central Government	6	2.8
Civil Defence	34	16.1
Local Council	5	2.4
Region Council	2	1.0
Business Establishment	2	1.0
Child's School	12	5.7
Research Organization	2	1.0
Other- media	31	14.7
Other- phonebook	11	5.2
Other	9	4.3

Many more participants had received information than had actively sought it out. The most common sources were friends or family, Civil Defence (most people who indicated Civil Defence specified that they had received a Civil Defence pamphlet in the mail), and the media.

15	**Where do New Zealand tsunamis come from?**	
total n= 211	***n***	**%**
Ocean/ Pacific	88	41.7
Tectonic Plates/ Earthquakes	42	19.9
Tasman/ Australia	8	3.8
South America	50	23.7
Kaikoura	7	3.3
New Zealand	10	4.7
Don't Know	43	20.4
Other	18	8.5

The majority of people answered either the ocean or the Pacific Ocean which is correct, though, really general. Almost a quarter of respondents knew that the most likely source for tsunamis was South America, however almost as many people responded that they did not know the source. The question had an unforeseen ambiguity, with some respondents interpreting the question to mean what caused tsunamis. This is why nearly 20% of people said that tsunamis come from earthquakes.

16	**Who do you think is responsible for issuing distant-source tsunami warnings to you?**	
total n= 211	***n***	**%**
Don't Know	19	9.0
Central Government	58	27.5
Regional Council	14	6.6
Local Council	12	5.7
Civil Defence	96	45.5
Local Police or Fire Service	13	6.2
NIWA	7	3.3
GNS	2	1.0
No one can	0	0.0
No one should	0	0.0
Other	52	24.6

17	**Who do you think is responsible for issuing local-source tsunami warnings to you?**	
total n= 211	***n***	**%**
Don't Know	18	8.5
Central Government	44	20.9
Regional Council	15	7.1
Local Council	21	10.0
Civil Defence	102	48.3
Local Police or Fire Service	21	10.0
NIWA	7	3.3
GNS	2	1.0
No one can	2	1.0
No one should	0	0.0
Other	24	11.4

Responses were widespread with most participants knowing that Civil Defence was responsible for issuing tsunami warnings to the public. Although, through the National Warning System all of these organizations are a part of the process so any answer would have been correct. There was little variation about who was responsible for local and distant source tsunami warnings.

18	**Does New Zealand have a tsunami warning system?**	
total n= 211	***n***	**%**
Yes	101	47.9
No	61	28.9
Don't Know	49	23.2

19	**What does the New Zealand public warning notification system consist of?**	
total n= 211	***n***	**%**
Radio	122	57.8
TV	55	26.1
Siren	57	27.0
Text	3	1.4
Word of Mouth	9	4.3
Don't Know	38	18.0
Other	51	24.2

Approximately half of respondents knew that New Zealand has a tsunami warning system and that it consists of radio broadcast. Only about a quarter, though, knew that there is TV broadcast as well. Many, 27%, also expected sirens, which few communities have.

20	**Which do you think would be the most effective way of delivering a warning?**	
total n= 211	***n***	**%**
Radio	101	47.9
TV	53	25.1
Siren	55	26.1
Text	13	6.2
Word of Mouth	21	10.0
Don't Know	3	1.4
Other	37	34.6

Most people preferred the existing methods of delivering a warning using radio and television broadcast. Also over a quarter of the participants referred a siren system. A siren system may be more appropriate to campground locations since there is limited radio and cell phone reception and few televisions.

21	**What are the natural signs of a tsunami, or the signs that a tsunami may have been generated?**	
total n= 211	***n***	**%**
Water recedes	159	73.4
Earthquake	13	6.2
Birds /animals leave	8	3.8
Noise of water	7	3.3
Big wave/ wall of water	34	16.1
Don't Know	7	3.2
Other	27	12.8

The two most important natural signs of an impending tsunami are the recession of the sea and the earthquake itself (deLange, 2003). The majority of respondents were aware of the drawing back of the sea, but most people only knew of that one natural sign. Since the water receding only occurs when the trough arrives first, this warning sign does not always occur and it is therefore important that people realize the other natural warning signs that occur such as the ground shaking from the earthquake, sea-level changes, wave forms, sounds, and animal behaviour (Gregg *et al*, 2006).

3.3.3 During a Tsunami

22	**In the event of a distant source, official tsunami warning what actions would you take?**	
total n= 211	***n***	**%**
Go uphill/to higher ground	144	68.3
Go inland	34	16.1
Travel by car	26	12.3
Travel on foot	5	2.4
Take children/family	23	10.9
Take supplies/essentials	20	9.5
Pack up camp	11	5.2
Don't know	2	1.0
Other	52	24.6

23	In the event of signs of a possible local-source tsunami, what actions would you take?	
total n= 211	***n***	**%**
Go uphill/to higher ground	139	65.9
Go inland	31	14.7
Travel by car	20	9.5
Travel on foot	9	4.3
Take children/family	23	10.9
Take supplies/essentials	7	3.3
Pack up camp	2	1.0
Leave belongings	7	3.3
Don't know	2	1.0
Other	46	21.8

The majority of participants knew to move either uphill or inland if a tsunami were to occur. Most participants did not indicate any different course of action for a local versus distant source tsunami. Some participant did specifically mention packing up camp or taking more supplies in the event of a distant tsunami or leaving belongings in the case of a local tsunami. The lack of differentiation may be because of the fast pace of the interview style surveying. Participants may have put in amore detailed and thought out answer for a written survey.

24	If you are at the coast and receive an official tsunami warning how much time do you have to move to safety?	
total n= 211	***n***	**%**
Don't know	22	10.4
A few minutes	27	12.8
10 minutes to half an hour	47	22.3
1-2 hours	52	24.6
2-5 hours	19	9.0
More than 5 hours	42	19.9
None	1	0.5

The most likely source of tsunamis for the Canterbury region is from distantly generated tsunamis originating from South America for which travel time is estimated at approximately 12-14 hours. An official tsunami warning from such a source would occur with a minimum of 3 hours warning time. The majority of people underestimated the time that they would have to move to safety even though most

participants understood the question to mean how long would it take the tsunami to arrive from a distant source.

25	**If you feel a strong earthquake while at the beach, how much time do you have to move to safety?**	
total n= 211	***n***	**%**
Don't know	26	12.3
A few minutes	91	43.1
10 minutes to half an hour	61	28.9
1-2 hours	14	6.6
2-5 hours	1	0.5
More than 5 hours	3	1.4
None	11	5.2
Wouldn't need to	3	1.4

Although some respondents believed that there would be no time or no need to move to safety, most, 72% knew that it would take between a few minutes to 15 minutes for a locally generated tsunami to arrive after an earthquake.

26	**What do you expect from campground/accommodation staff during a tsunami?**	
total n= 211	***n***	**%**
Nothing	35	16.6
Evacuate themselves	11	5.2
Warn people	50	23.7
Provide information	51	24.2
Evacuate people	13	6.2
Have a meeting point	11	5.2
Organize people	2	1.0
Set off siren/alarm	25	11.6
Other	72	34.1

The most common response was that guest expected either information or a warning from campground owners or staff. A large percentage expected owners or staff to do nothing. Other respondents expected a prearranged meeting location, for staff to organize the people to evacuate or to facilitate an evacuation, or that staff would set off an alarm or siren.

3.3.4 Changes in Perception

27	Did you know what a tsunami was before the 2004 Boxing Day tsunami?	
total n= 211	***n***	**%**
Yes	180	85.3
No	31	14.7

28	Since the 2004 Boxing Day tsunami you:	
total n= 211	***n***	**%**
Have learned more about tsunamis	177	83.9
Have actively sought information on tsunamis	1	0.5
Feel more at risk from tsunamis	71	33.7
Feel less at risk	15	7.1
Have not been affected	23	10.9
Fell more aware about tsunamis	11	5.2
Other	5	2.4

Even though the majority of participants, 85.3%, indicated that they knew what a tsunami was prior to the Boxing Day Tsunami, 83.9% indicated that they had learned more about tsunamis since then. Moreover, out of the 31 respondents who did not know what a tsunami was beforehand, only 3 or 9.6% have not learned more about tsunamis since.

3.4 Discussion

Although there is a common belief in the possibility that tsunamis could and have occurred, there is only moderate understanding of the warning system including who issues warnings and how they are received. The majority of participants indicated a preference for the existing method of receiving warning by radio broadcast. Most individuals were generally aware of the proper actions to take during a tsunami, but responses given for local and distantly generated tsunamis varied only marginally. This is consistent with the facts that most respondents underestimated the time for evacuation from a distant tsunami believing that they would not have much more time than a local tsunami.

In study by Drabek (2000), he found that visitors had higher expectations of accommodations personnel than managers/owners were willing or able to provide including that they should have written disaster plans that incorporated the needs for

disabled individuals or those with language barrier issues. Campground visitors had generally lower expectations of the staff in regards to hazard preparation and evacuations. They often cited the lower number of employees present and the need for the staff to self-evacuate. Of the campground surveyed, only one, Okains Bay, had any visible hazards notices in regards to appropriate actions to take in case of a brush fire. The office also had an "emergency plan" regarding flooding or tsunamis. In his survey of 185 executives in the tourism industry Drabek (1995a and 1995b) found that although there had been some degree of planning it was mostly informal. The Okains Bay plan was definitely of an informal nature (Figure 3.13).

Emergency Procedures in case of Flooding (Tsunami Warning)

Ring emergency services

Ring members on telephone tree

Evacuate everyone to high ground

Account for all people at all times

Keep "sightseers" away from beach area

Do not drink floodwater

Figure 3.13: Okains Bay emergency plan regarding flooding or tsunamis.

It is important, however, for managers and staff to understand the nature of hazards and to have plans in place, because they are often the first source of information for tourist or when the media is the first source individuals will often seek to confirm the information with accommodations operators (Drabek, 2000). Of those visitors surveyed, about a quarter expected information and about a quarter expected some degree of warning from campground owners/staff. This is especially important in the campground situation with minimal forms of media communication available especially in the Banks Peninsula sites where cell phone coverage is limited to non-existent, few radio stations are available and televisions are very rare. Although the

coastal Christchurch locations had better reception, it is common for campground visitors not to have a radio or to spend minimal time using it.

With respect to changes in perception since Boxing Day, the majority of participants noted some change with many learning more about tsunamis (see Chapter 6).

Chapter 4
Resident Survey

4.1 Introduction

During June of 2003, through a collaborative effort of GNS and NIWA, a large-scale national survey of residents and visitors was undertaken to examine perceptions of and preparedness for coastal hazards, especially tsunamis and coastal erosion (Johnson *et al,* 2003). It was decided to resurvey those populations in 2006 in the continuing effort to understand resident's awareness of coastal hazards with particular emphasis on tsunamis and to examine what changes in perceptions may have occurred as a result of the 2004 Boxing Day Tsunami.

4.2 Methodology

A postal questionnaire was delivered to residents of five coastal communities in the Canterbury Region during October of 2006. The communities were Kaikoura, New Brighton, Pareora, Southshore and Sumner (figure 4.1) and were chosen because all but Pareora were surveyed as part of the National Coastal Survey carried out by GNS in 2003. Pareora was added at the request of the regional council since it is a high-risk location. Addresses from the 2003 survey were reused. A total of 710 surveys were posted during the initial send-out; 100 to Kaikoura, 150 to New Brighton, 160 to Pareora, 150 to Southshore, and 150 to Sumner. A second follow-up mailing was conducted after three weeks to increase the return rate

The survey was based on several other surveys to allow cross comparison of data afterwards including the 2003 National Coastal Survey, the campground survey of non-residents used in Chapter 2, and a similar tsunami survey that was conducted in Oregon, USA earlier in 2006. The questionnaire was composed of scaled questions and open and closed ended questions and the main themes included:

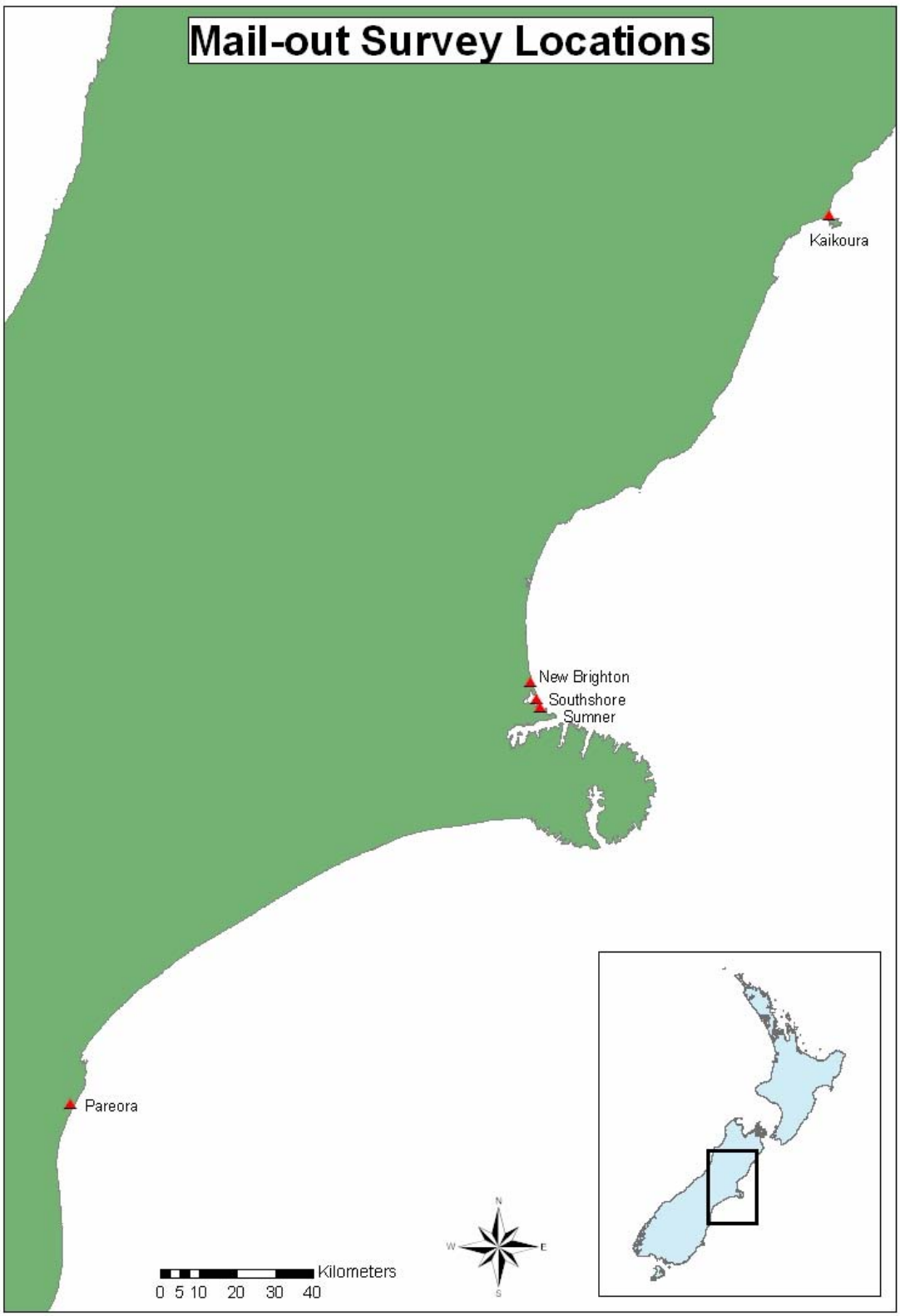


Figure 4.1: Locations of the five communities that were surveyed.

Risk perception and hazard experience: This consisted of questions on the two most likely hazards to affect the community, the likeliness of tsunamis occurring in the future, individual susceptibility to harm from tsunamis, and previous hazards that had affected them and two what degree they had been impacted.

General tsunami knowledge: Participants were asked about the most common cause of tsunamis, how they occur, when the last tsunami affected their community, what they would do during and event, and how much time they would have to move to safety after either an official warning or an earthquake.

Tsunami warnings: This included questions the components of New Zealand's warning system, who is responsible for issuing warnings, and which natural and official warnings would be received.

Sources of information and preparedness: Residents were asked whether they had heard, received, or asked for information on tsunami hazards from a variety of sources, what steps they were taking to become more prepared, what had prompted their preparedness, what emergency supplies they had, and how often they checked emergency supplies.

Attitude about community: This consisted of questions on the respondent's interest, involvement, and time spent in the community, residential status, and reasons for living in the community.

Survey data was analysed with SPSS statistical software. In order to simplify the results answers to open ended questions were categorized and have been reported by those categories. The full answers and any answers reported in the "other" category are located in Appendix 3.

4.3 Response Rate

Out of the 710 total posted questionnaires, 54 were returned as undeliverable and 172, 26.4% were returned completed. Response rates varied between 18.3% and 39.5% for the individual communities (table 4.1). Response rates for all communities were lower than those of the 2003 National Coastal Survey as reported by Johnson *et al (*2003) with Southshore still having the highest rate.

Location	Total No. Mailed	Non-deliverable	No. Returned	Return Rate	Return Rate 2003
All	710	54	172	26.2%	40.0%
Kaikoura	100	16	25	29.8%	36.0%
New Brighton	150	8	26	18.3%	37.3%
Pareora	160	6	30	19.5%	NA
Southshore	150	3	58	39.5%	52.0%
Sumner	150	21	33	25.5%	34.7%

Table 4.1: Return rate.

According to Punch (2003) response rates of at least 60% should be aimed for, although, rates of 30-40% or less are not uncommon for mail-out surveys. Low response rates are also to be expected when studying hazards that have a low frequency of occurrence (Johnson *et al*, 2002). The Ten Variable Model of Predicting Final Response Rate (Jackson, 1988) uses different variables including the type of organization sponsoring the survey, population type being surveyed, length of the questionnaire, number of follow-up contacts, salience of the topic, and whether there is any incentive given to complete the survey to estimate the final return rate. Using this method the expected return rate for this survey is 39.8%, which is acceptable according to Jackson (1988) since it is within 25 percent of the predicted response rate.

4.4 Representativeness of the sample

The goal of randomly sampling the general public is to gain a representative sample. Table 4.2 compares the demographic information of survey respondents with the

demographics of the 2006 Census of Populations and Dwellings for the Canterbury Region.

Characteristic	Survey Result %	Canterbury 2006 Census %
Gender		
Male	46.5	48.8
Female	52.9	51.2
Ethnicity		
New Zealand European	89.8	75.4
Maori	1.2	7.0
Pacific Islander	0.0	2.9
Asian	0.0	5.6
Other	9.0	14.7
Age		
15-19	0.0	7.2
20-29	6.9	12.4
30-39	18.2	14.3
40-49	17.6	15.1
50-59	28.3	12.7
60+	28.9	18.6
Employment Status		
Employed full-time	35.8	39.0
Employed part-time	17.6	12.6
Not in paid employment	30.3	27.1
Annual Income		
Under $5,000	0.0	5.8
$5,000 to $15,000	8.7	16.1
$15,001 to $20,000	8.0	7.2
$20,001 to $30,000	12.7	12.0
$30,001 to $40,000	12.0	10.8
$40,001 to $50,000	10.7	6.8
$50,001 +	48.0	11.6
Highest Educational Qualification		
No school qualifications	11.4	18.9
Secondary school qualifications	23.5	36.76
Trade or professional certificate or diploma	33.7	7.3
University undergraduate degree	23.5	7.3
University postgraduate degree	7.8	3.2

Figure 4.2: Representativeness of the survey sample.

The survey sampled is moderately representative of the target population. Although all major groups are represented, there was significant under-representation of Maori, Pacific Islanders and Asians, younger age groups and low-income individuals. On the other hand older age groups, wealthier individuals, and those with trade certificates and undergraduate degrees are over-represented. These over-represented groups embody socially empowered (Leonard *et al*, 2004) individuals who tend to have greater resources, authority and control over their environment. A demographic bias towards this group it is not uncommon in such voluntary surveys and has been seen in previous New Zealand studies (Leonard *et al,* 2004).

4.4 Results

4.4.1 Awareness and experience of natural hazards in general

1	**Which are the two natural hazards that you think are most likely to affect this community? (Tick only two)**	
total n= 170	***n***	**%**
Ash fall from a volcanic eruption	1	0.6
Coastal erosion (shoreline erosion)	63	37.1
Earthquake	75	44.1
Flooding (river or storm surge)	47	27.6
Forest or bush fire	3	1.8
Landslide	5	2.9
Storm or cyclone with high winds	40	23.5
Tsunami (previously called tidal wave)	100	58.8

Over half of all respondents believe that tsunamis have the greatest potential to affect their community while earthquake was believed to be the second highest hazard. Very few people indicated fire, landslide or ash fall to be the most likely. Coastal erosion, flooding and storm were of moderate concern.

2	**Have you ever been affected by any of the following events? Tick all that apply)**	
total n= 161	***n***	**%**
Chemical spill or gas leak	8	5.0
Climate change	14	8.7
Earthquake	49	30.4
Fire	19	11.8
Flood	37	23.0
Infrastructural failure (e.g. loss of electricity)	69	42.8
Landslide	8	5.0
Pandemic	0	0.0
Storm with high winds (e.g. cyclone)	38	23.6
Tornado	2	1.2
Volcanic eruption	2	1.2
No events have affected me	45	28.0

The hazard that affected the largest number of people was infrastructural failure. This most likely referred to the snow that blanketed the South Island during the 2006 winter, during which power service was interrupted for two to three weeks at some locations (figure 4.2). Over a third of respondents have experienced earthquakes making this the next greatest hazard, although this was closely followed by a third of participant reporting that no natural hazards had affected them. The number of people affected by "no hazards", however, may be slightly higher. About thirteen individuals did not specify any particular hazards, but also did not indicate "no events". This was quite possibly due to individuals not reading through the entire list since the "no events" selection was located at the bottom. Flood and fire affected the next greatest number of people and chemical spill, climate change, landslide, pandemic, tornado, and volcanic eruption each affected under ten percent of respondents.

Figure 4.10: Snowfall from the 2006 snowstorm (NASA, 2006).

2a	**If you have been affected, to what extent were you affected? (consider property damage, injuries and financial impact). In each row tick the one number you feel best represents this impact, on the scale from 1 to 10. 1- little impact, 10- severe impact**										
		n									
	T	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Chemical spill or gas leak	**9**	2	2	1	0	1	1	0	1	0	1
Climate change	**17**	3	5	3	0	1	3	1	1	0	0
Earthquake	**47**	2	5	2	1	3		1	2	0	0
Fire	**19**	2	5	2	1	3	3	1	2	0	0
Flood	**37**	9	5	5	5	1	3	3	4	1	1
Infrastructural failure	**63**	15	8	11	7	8	6	4	3	0	1
Landslide	**8**	1	1	2	2	1	1	0	0	0	0
Pandemic	**1**	1	0	0	0	0	0	0	0	0	0
Storm with high winds	**42**	4	8	11	7	4	1	3	2	2	0
Tornado	**3**	2	0	0	0	0	0	0	1	0	0
Volcanic eruption	**3**	1	1	1	0	0	0	0	0	0	0

2a	**%**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Chemical spill or gas leak	1.2	1.2	0.6	0.0	0.6	0.6	0.0	0.6	0.0	0.6
Climate change	1.9	3.1	1.9	0.0	0.6	1.9	0.6	0.6	0.0	0.0
Earthquake	1.2	3.1	1.2	0.6	1.9	1.9	0.6	1.2	0.0	0.0
Fire	1.2	3.1	1.2	0.6	1.9	1.9	0.6	1.2	0.0	0.0
Flood	5.6	3.1	3.1	3.1	0.6	1.9	1.9	2.5	0.6	0.6
Infrastructural failure	9.3	5.0	6.8	4.3	5.0	3.7	2.5	1.9	0.0	0.6
Landslide	0.6	0.6	1.2	1.2	0.6	0.6	0.0	0.0	0.0	0.0
Pandemic	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Storm with high winds	2.5	5.0	6.8	4.3	2.5	0.6	1.9	1.2	1.2	0.0
Tornado	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Volcanic eruption	0.6	0.6	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Although some participants indicated that they were affected severely the mean average for all hazards is 4.2, which implies that generally participants have not been impacted by any extreme events. The hazards that have had the most severe impact on participants were earthquake, fire, climate change, flood, and infrastructural failure, while pandemic, tornado, volcanic eruption and landslide have had the least impact. Although all hazards have some representation, pandemic may have been

chosen in error. The individual had chosen landslide under the previous question and most likely ticked the next box down by accident.

4.4.2 General tsunami questions

3	**What is the most frequent cause of tsunamis in general? (Tick only one)**	
total n= 170	***n***	**%**
Landslide	1	0.6
High tide	3	1.8
Hurricane/storm	1	0.6
Earthquake	160	94.1
Volcanic Eruption	5	2.9
Don't know	0	0.0

Almost all participants, over ninety percent, correctly identified that earthquakes are the most frequent cause of tsunamis. A few people selected landslide and volcanic eruptions, which do generate tsunamis; however, they are not the most common cause. A few people also incorrectly indicated that tsunamis were produce from high tide; this is mostly likely because tsunamis were formerly referred to as tidal waves.

4	**Tsunami waves can occur as which of the following: (Tick all that apply)**	
total n= 168	***n***	**%**
One big wave/surge	79	47.0
Multiple big waves/surges	97	57.7
One small wave/surge	36	21.4
Multiple small waves/surges	46	27.4
Multiple big waves/surges and multiple small waves/surges	96	57.1
Rapidly rising and falling water level	82	48.8
Don't Know	7	4.2

Tsunami waves can occur as any of the above, hence the wide and generally even distribution among all responses, though, more participants chose multiple big waves, and multiple big and multiple small waves.

5	When was the last tsunami that affected this community? (Tick only one)	
total n= 171	***n***	**%**
Never	26	15.2
In the last 10 years	7	4.1
In the last 100 years	78	45.6
In the last 1000 years	5	2.9
In the last 10 000 years	0	0.0
Don't know	55	32.2

The greatest number of participants believed that the last tsunami was in the last hundred years, though a third of respondents did not know. A small amount of individuals responded that one had occurred as few as ten years or a long as one thousand years ago and no one believed that it had been ten thousand years.

6	When was the last ***damaging*** tsunami that affected this community? (Tick only one)	
total n= 170	***n***	**%**
Never	44	25.9
In the last 10 years	0	0.0
In the last 100 years	39	22.9
In the last 1000 years	8	4.7
In the last 10 000 years	1	.6
Don't know	78	45.9

Over half of individuals did not know when the last damaging tsunami was. Of those that though they knew about equal numbers believed it was never and in the last hundred years.

7	Do you think a tsunamis could occur: (Tick only one)	
total n= 169	***n***	**%**
Within the year	22	13.0
In the next 1-10 years	42	25.0
In the next 10-100 years	65	38.5
Not within 100 years	2	1.2
Never	3	1.8
Don't know	35	20.7

The majority of participants though that a tsunami was likely and would occur within 10-100 years, with 1-10 years coming in close second. Most, however, did not believe that a tsunami would occur imminently. Few respondents believe that a tsunami will never occur.

4.4.3 Tsunami warnings and preparation

8	Have you seen any tsunami hazard zone maps for this community?	
total n= 169	***n***	**%**
Yes	27	16.0
Not sure	6	3.6
No	136	80.5

Most respondents, almost 80%, have not seen tsunami hazard zone maps for their community.

9	Do you live in a tsunami inundation (hazard or danger) zone? (Tick only one)	
total n= 169	***n***	**%**
Yes	122	72.2
No	11	6.5
Don't Know	36	21.3

The majority of individuals indicated that they live in a tsunami inundation zone, which is within one kilometre of the ocean and below 35 meters in elevation. The communities were chosen due to their proximately to the ocean and their likely inundation during a tsunami.

10	Which of the following make up New Zealand's public tsunami warning system? (Tick all that apply)	
total n= 161 total n= 169	***n***	**%**
Don't know	36	22.4
Siren	113	70.2
Loudspeaker announcements	42	26.1
Flashing lights	10	6.2
Radio and TV announcements	119	73.9
Door-to-door visits by emergency services or civil defence staff	51	31.7
Other	3	1.9

Participants indicated that sirens and radio and TV announcements were the components of New Zealand's warning system. Though most people responded that sirens were a component they are not incorporated into the National Warning System.

11	What do you think would be the most effective way of delivering a warning?	
total n= 134	***n***	**%**
Don't know	1	0.7
Siren	99	73.9
Loudspeaker announcements	39	29.1
Flashing lights	9	6.7
Radio and TV announcements	54	40.3
Door-to-door visits by emergency services or civil defence staff	28	20.9
Other	17	12.7

Most individuals preferred sirens as a method of communicating a warning, though this is as of yet not used at any location. It is uncertain whether or not fire sirens would be used in the event of a tsunami. Approximately a third favoured radio and TV announcements. The least desired method was flashing lights.

12	Who is responsible for issuing tsunami warnings? (Tick all that apply)	
total n= 170	***n***	**%**
Don't know	26	15.3
Central government	44	25.9
Regional council	43	25.3
Local Council	46	27.1
Local Civil Defence group	113	66.5
Police or Fire Service	66	38.4
NIWA or GNS	39	22.7
Other	4	2.4

Responses were widespread with most participants knowing that Civil Defence was responsible for issuing tsunami warnings directly to the public. Although, through the National Warning System all of these organizations are a part of the process so any answer would have been correct.

15	To what extent to you agree that: (Tick one for each statement) 1-Strongly disagree -– 5 – Strongly agree										
	n						**%**				
	T	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Tsunamis are too destructive to bother preparing for	**161**	90	25	20	14	12	55.9	15.5	12.4	8.7	7.5
A serious tsunami is unlikely to affect me in the future	**164**	59	48	31	15	11	36.0	29.3	18.9	9.1	6.7
It is unnecessary to prepare for tsunamis as assistance will be provided for me by Civil Defence	**163**	98	40	16	3	6	60.1	24.5	9.8	1.8	3.7
Preparing for tsunamis is inconvenient for me	**163**	65	34	38	18	8	39.9	20.9	23.3	11.0	4.9
It is difficult to prepare for tsunamis	**166**	33	31	40	34	28	19.9	18.7	24.1	20.5	16.9
Preparing for tsunamis will reduce damage to my home	**164**	49	39	32	23	21	29.9	23.8	19.5	14.0	12.8
Preparing for tsunamis will improve my everyday living conditions	**164**	53	40	38	22	11	32.3	24.4	23.2	13.4	6.7
Preparing for tsunamis will improve my ability to deal with disruption to family/community life	**164**	21	13	25	62	43	12.8	7.9	15.2	37.8	26.2
Preparing for tsunamis will help save lives	**165**	8	10	14	37	96	4.8	6.1	8.5	22.4	58.2
I do not know how I can prepare for tsunamis	**162**	24	30	36	33	39	14.8	18.5	22.2	20.3	24.1

Over half of participants strongly disagreed with the facts that tsunamis are too destructive to bother with, that is it unnecessary to prepare for tsunamis. Many people, about a third, disagreed that a serious tsunami would not affect them, that preparing for tsunamis will reduce damage to their home and improve their everyday living conditions and that preparing is too inconvenient. Individuals strongly agreed that preparing will help save lives. There was generally mixed feelings about knowing how to prepare and whether preparing is too difficult.

Altogether, respondents believed in preparing and what it will do for them personally and that it is possible and necessary to prepare for tsunamis.

16	**Have you heard or received information about preparing for tsunami hazards from any of the following? (Tick all that apply)**	
total n= 170	***n***	**%**
I haven't heard or received any information	73	42.9
Friends	20	11.8
Neighbours	7	4.1
Relatives	12	7.1
Central Government	16	9.4
Region Council	30	17.6
Local Council	37	21.8
Local Civil Defence group	46	27.1
Business establishments	1	0.6
Research Organization	19	11.2
My workplace	9	5.3
My child's school	5	2.9
Other- phonebook	10	5.9
Other	17	10.0

Over half of participants responded that they did not hear or receive information from any source. The sources most often indicated were friends, regional and local council, local Civil Defence and research organizations. The least preferred sources were neighbours, business establishments, and through their child's school (though this may be from the low number of individuals with children in school).

17	**In the next month or so, do you intend to: (Tick one for each statement)**						
	n				**%**		
	T	**No**	**Possibly**	**Definitely**	**No**	**Possibly**	**Definitely**
Improve your knowledge of how to respond to tsunamis	**167**	46	102	19	27.5	61.1	11.3
Increase your ability to respond to tsunamis	**165**	46	99	20	27.5	60.0	12.1
Become involved with a local group/neighbourhood to discuss how to respond to tsunamis	**166**	119	42	5	71.7	25.3	3.0
Seek information on tsunami risks	**164**	68	68	28	41.5	41.5	17.1
Seek information on things to do to respond to tsunamis	**164**	48	87	29	29.3	53.0	17.7

Not many respondents definitely intended to improve their knowledge on how to or increase their ability to respond to tsunamis, become involved with local groups, or seek information on tsunami risks or how to respond to them, although almost half indicated that they possibly would. This is consistent with low-probability events.

18	**Have you asked any of the following people, groups, or organisations for information on how to get ready for tsunami hazards? (Tick all that apply)**	
total n= 170	***n***	**%**
No, I haven't asked anyone	148	87.1
Friends	9	5.3
Neighbours	4	2.4
Relatives	9	5.3
Central Government	1	0.6
Region Council	2	1.2
Local Council	1	0.6
Local Civil Defence group	8	4.7
Business establishments	1	0.6
Research Organization	2	1.2
My workplace	4	2.4
My child's school	2	1.2
Other	0	0.0

Generally, participants have not asked for information from any sources. Less than 25 % of participants have asked for information from any source. Of those that had the preferred sources were relatives, friends and local Civil Defenceless.

19	**Are there official tsunami evacuation routes for this community? (Tick only one)**	
total n= 169	***n***	**%**
Yes	17	10.1
No	28	16.6
Don't know	124	73.4

Almost three quarters of respondents did not know if there is an official tsunami evacuation route. Those that believed there are usually indicated that there was only one possible road to leave by so that would be it (see appendix 3). This was most often reported from New Brighton residents.

19b	If no do you think that an official evacuation route should be established? (Tick only one)	
total n= 118	***n***	**%**
Yes	101	84.9
No	17	14.3

Although most participants indicated that they believed an official route should be established. Some respondents replied that they believed an evacuation route should not be established with at least one individual citing that this would cause traffic problems.

20	Are you currently becoming more "tsunami prepared"? (Tick only one)	
total n= 168	***n***	**%**
Yes	56	33.3
No	94	56.0
Don't know	18	10.7

Just over half of respondents indicated that they are not becoming tsunami prepared, although about 10 % were not sure what that meant.

21	Which of the following steps have you taken or are taking to become more tsunami prepared? (Tick one per line)						
	n				**%**		
	T	**No**	**Yes**	**Does not apply**	**No**	**Yes**	**Does not apply**
a. Developing a family emergency response plan	**158**	85	58	15	53.8	36.7	9.5
b. Have a back pack filled with supplies that is ready to take with me	**158**	103	45	10	65.2	28.5	6.3
c. Participated in an official tsunami drill	**155**	141	4	10	91.0	2.6	6.5
d. Participated in an unofficial tsunami drill	**154**	139	6	9	90.3	3.9	5.8

The majority of individuals were not preparing in any of the above listed ways. The most common preparations were to have a family emergency plan and to have a pack filled with supplies. These are probably most common since these steps are appropriate for more than tsunami emergencies.

22	Please indicate how much you agree or disagree that the following sources of information influenced your willingness to prepare. (Tick one per line) 1-Strongly disagree -– 5 – Strongly agree										
	n						**%**				
	T	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
a. Public education meetings	**136**	49	28	28	18	13	36.0	20.6	20.6	13.2	9.6
b. World events such as the 2004 Indian Ocean Tsunami	**150**	6	9	32	50	53	4.0	6.0	21.3	33.1	35.3
c. Neighbourhood educators (door to door)	**134**	61	23	36	8	6	45.5	17.2	26.9	5.9	4.5
d. School programs	**129**	48	20	30	15	16	37.2	15.5	23.3	11.6	12.4
e. Council Newsletters	**146**	29	17	37	39	24	19.9	11.6	25.3	26.7	16.4
f. Public tsunami drills	**133**	58	18	29	21	7	43.6	13.5	21.8	15.8	5.2

The sources with the greatest indicated influence are world events such as the 2004 Indian Ocean Tsunami. Most respondents disagreed that public education meetings, neighbourhood educators, school programs, or public tsunami drills influenced their willingness to prepare. There was mixed agreement on the importance of council newsletters, though a newsletter was returned with one survey (see chapter 5).

23	Did you know what a tsunami was before the 2004 Boxing Day Tsunami	
total n= 170	***n***	**%**
Yes	159	93.5
No	11	6.5

Most individuals reported that they knew what a tsunami was prior to the Boxing Day event.

24	Since the 2004 Boxing Day Tsunami you: (Tick all that apply)	
total n= 170	***n***	**%**
Have learned more about tsunamis	111	64.5
Have actively sought more information about tsunamis	25	14.7
Feel more at risk from tsunamis	94	55.5
Feel less at risk from tsunamis	3	1.8
Have not been affected	44	25.9
Other	3	1.8

Even though the majority of participants, indicated that they knew what a tsunami was prior to the Boxing Day Tsunami, 64.5% indicated that they had learned more about tsunamis since then. Also, over half of respondents feel more at risk since the 2004 tsunami.

4.4.4 During a tsunami

25	**Describe how you would respond to a warning of a *local* source tsunami (from a place less than 1 hour travel time away).**	
total n= 164	***n***	**%**
Move to high ground/ uphill	92	56.1
Move inland	50	30.5
Take supplies/ essentials	38	23.2
Take family and pets	31	18.9
Inform friends and neighbours	9	5.5
Seek information	3	1.8
Other	50	30.5

Over half of participants indicated that they would move either uphill or inland in response to a tsunami. Some individuals, about 20%, noted the importance of packing up family members and pets or taking essentials or emergency supplies wit them. Few people said that they would take the time to inform neighbours or seek more information.

26	**Describe how your response to a warning of a *distant* source tsunami (originating from Japan or Alaska, etc) would <u>differ</u> from your response to a local tsunami.**	
total n= 158	***n***	**%**
I will follow instructions	10	6.3
Pack and/or take supplies/more supplies	52	32.9
Inform friends and/or neighbours	7	4.4
Seek information	24	15.2
Response will not differ	25	15.8
Have more time	13	8.2
Other	47	29.7

The greatest way in which individual's action would differ during a distant tsunami was that they would take more supplies or pack more belongings. Participants also indicated that they would seek additional information in order to confirm the need to evacuate. Many noted that their response would not be different. A small

percentage said that they would follow instructions, have more time, or inform friends or neighbours. Although only about 6% indicated that they would follow instructions this does not mean that 94% would not follow instructions. This was an open-ended question so it is possible that participants were considering active responses or just did not consider this as a possible answer.

27	**If you are at the coast and receive an official tsunami warning how much time do you have to move to safety? (Tick only one)**	
total n= 161	***n***	**%**
Don't know	63	39.1
A few minutes	33	20.5
10 minutes to half an hour	35	21.7
1-2 hours	21	13.0
2-5 hours	10	6.2
More than 5 hours	1	0.6
None	1	0.6

The most likely source of tsunamis for the Canterbury region is from distantly generated tsunamis originating from South America for which travel time is estimated at approximately 12-14 hours. An official tsunami warning from such a source would occur with a minimum of 3 hours warning time. Most individuals underestimated the time they would have with the majority responding that they would have under an hour. Also a large percent responded that they did not know.

28	**If you feel a strong earthquake while at the beach, how much time will you have to move to safety? (Tick one only)**	
total n= 168	***n***	**%**
Don't know	69	41.1
A few minutes	61	36.3
10 minutes to half an hour	21	12.5
1-2 hours	9	5.4
2-5 hours	7	4.2
More than 5 hours	1	0.6

Although most respondents did not know how long they would have to move to safety, most of those that did knew that it would take between a few minutes to under half an hour for a locally generated tsunami to arrive after an earthquake.

29	During a tsunami, how much time can there be between one tsunami wave/surge and the next? (Tick one only)	
total n= 171	***n***	**%**
1-15 minutes	58	33.9
16-30 minutes	4	2.3
Over 30 minutes	1	0.6
All of the above	48	28.1
Don't know	60	35.1

The greatest number of participants answered that they did not know the time between tsunami waves. About a third believed it to be between one to fifteen minutes.

30	Would you take personal belongings with you during a <u>local</u> source tsunami warning? (Tick only one)	
total n= 171	***n***	**%**
Yes	64	37.4
No	90	52.6
Don't know	17	9.9

Although over half of participants indicated that they would not take supplies about a third said that they would, however many of those noted on the side that it would only be essentials.

31	Would you take personal belongings with you during a <u>distant</u> source tsunami warning? (Tick only one)	
total n= 167	***n***	**%**
Yes	139	83.2
No	12	7.2
Don't know	16	9.6

There was a marked increase in the number of people who said they would bring belongings during a distant tsunami versus a local one. Over 80% of participants indicated that they would bring belongings during a distantly generated tsunami whereas only about a third responded that they would during a locally generated one.

32	**If you currently have personal belongings stored to take with you when a tsunami warning is issued, please list the three most important items to your health/welfare.**	
total n= 169	***n***	**%**
Water	80	47.3
Food	68	40.2
Medication	37	21.9
Clothing	41	24.3
Shelter	9	5.3
Photo albums and personal mementos	6	3.6
Cash/card/wallet	4	2.4
Legal documents	16	9.5
1st aid kit	8	4.7
Radio	13	7.7
Other	64	37.9

Food, water, clothing and medication were the items listed with the greatest frequency as the most important to people. It should not be interpreted that all individuals that answered this question actually have items stored to be used during an emergency. Participants may not have read the question thoroughly since many respondents listed spouses, pets, children, and other such items that would not be found in an emergency pack. It is assumed that those individuals understood the question to mean what would be brought with them when evacuating during a tsunami.

33	For each statement, tick the box which best describes your response: (Tick one per line) 1-Strongly disagree -– 5 – Strongly agree										
	n						**%**				
	T	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
I think tsunamis could pose a threat to my personal safety	**164**	12	7	17	48	80	7.3	4.2	10.4	29.3	48.8
I think tsunamis could pose a threat to my daily activities (such as work, leisure or property)	**161**	11	12	17	42	79	6.8	7.5	10.6	26.1	49.1
The tsunami that may occur here won't be that bad	**166**	62	45	34	11	14	37.3	27.1	20.5	6.6	8.4
Tsunamis won't affect this area	**166**	99	31	15	10	11	59.6	18.7	9.0	6.0	6.6
Tsunamis won't affect me	**166**	96	31	20	7	12	57.8	18.7	12.0	4.2	7.2
The likelihood that major tsunamis will occur here has been greatly exaggerated	**165**	49	41	43	18	14	29.7	24.8	26.1	10.9	8.5
Tsunamis have affected this area since I have lived here	**165**	113	12	15	7	18	68.5	7.3	9.1	4.2	10.9
I will be fine if any tsunami hits here in the future	**166**	83	37	29	7	10	50.0	22.3	17.5	4.2	6.0

On average people strongly agreed that tsunamis could pose a threat to their daily activities and personal safety. Most people strongly disagreed with the fact that tsunamis would not affect their area or themselves and that they would be fine if a tsunami were to occur. They also disagreed that tsunamis have affected their area since they have lived their, which is to be expected since the last major tsunami occurred in 1960 (see Chapter 2).

34	Please list the components of your community's warning system?	
total n= 168	***n***	**%**
Siren	44	26.2
Loud speaker	2	1.2
TV and Radio	14	8.3
Door-to-door	3	1.8
I do not know if my community has a system	93	55.4
My community has a system but I don't know the components	38	22.6
Other	16	9.5

The greatest number of people responded that they do not know if their community has a warning system. The next greatest response was almost equally split between the fact that respondents did not know the components and that there were sirens as a component. Since sirens are not a component, this indicated that most people are unaware of how they would be receiving a warning.

35	What advice have you been given about what to do during a *tsunami evacuation*?	
total n= 130	***n***	**%**
Have an emergency supplies	6	4.6
Follow instructions	3	2.3
Evacuate after an earthquake	4	3.1
Listen to Radio	2	1.5
Move to higher ground/inland	30	23.1
None	63	48.5
Other	10	7.7

The majority of participants have not received advice on what to do during a tsunami. The most common advice that had been obtained was to move to higher ground.

36	Does our child's school have a disaster preparedness plan that includes tsunamis? (Tick only one)	
total n= 36	***n***	**%**
Yes	10	27.8
No	4	11.1
Don't know	22	61.1

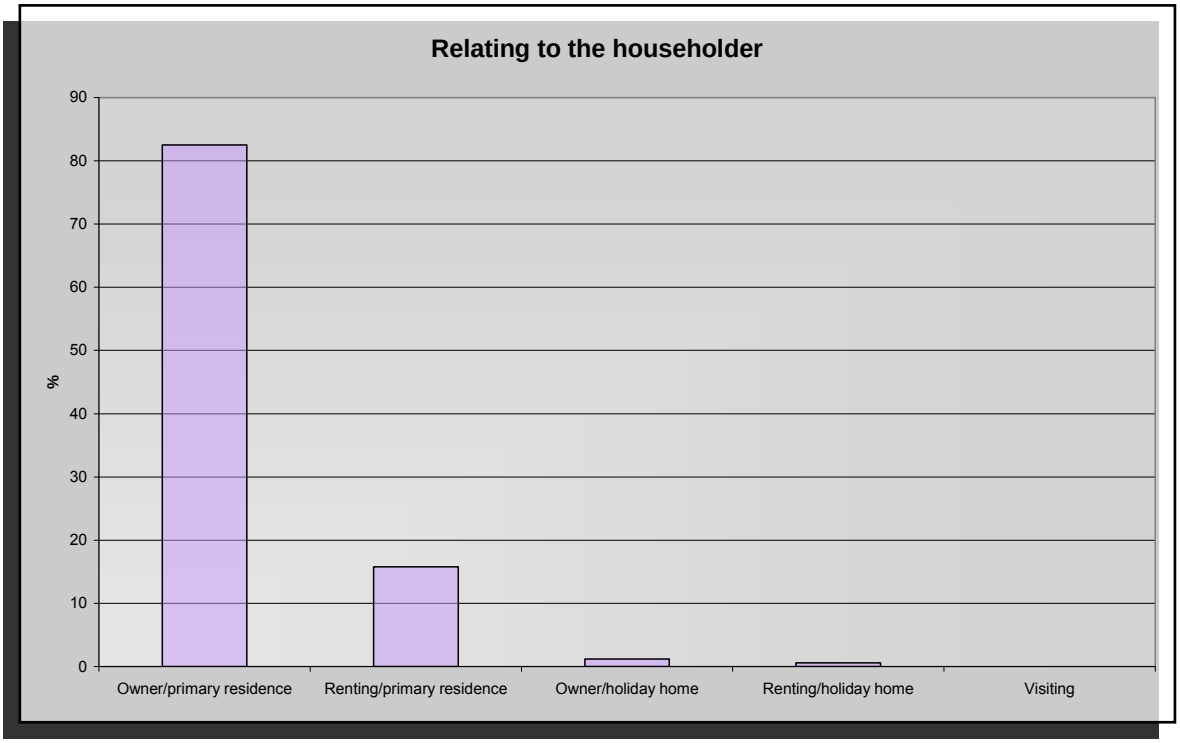
Approximately 32% of individuals responded that they had children in the demographics section, though only about 20% responded to this section, however not all of children may have been of school age. Of these most did not know if their child's school had a disaster plan in case of a tsunami.

37	**Please indicate the extent to which you agree or disagree with each of the following statements: 1-Strongly disagree -– 5 – Strongly agree**										
	n						**%**				
	T	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
a. I will allow my child to remain at school when a tsunami **warning** is issued	**35**	22	3	1	6	3	62.9	8.6	2.9	17.1	8.6
b. I will go and get my child from school when a tsunami **warning** is issued	**35**	5	2	6	7	15	14.3	5.7	17.1	20.0	42.9
c. I trust the tsunami preparedness plan at my child's school will protect my child during a tsunami event	**33**	9	4	10	3	7	25.7	11.4	28.6	8.6	20.0

Most respondent indicated that they would go and get their child from school during a tsunami event and that they had some trust in their school's preparedness plan.

4.4.5 Attitude about community

38	**Relating to the householder who is answering this questionnaire are you:**	
total n= 171	***n***	**%**
The owner and this is your primary residence	141	82.5
Renting and this is your primary residence	27	15.8
The owner and this is your holiday home	2	1.2
Renting and this is your holiday home	1	0.6
Visiting and neither rent nor own	0	0.0



Most respondents were at their primary residence, 98.3 %, and the majority were the owners 82.0 %. There were very few visitors were surveyed.

39	**The following is a list of statement on how you feel about living in this community. Please use the scale below to show how much each statement matches your views. (Tick one per line) 1-Strongly disagree -– 5 – Strongly agree**

	n						**%**				
	T	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
I feel 'at home' in this community	**164**	0	2	19	45	98	0.0	1.2	11.6	27.4	59.8
I am satisfied living in this community	**163**	0	4	12	54	93	0.0	2.5	7.4	33.1	57.0
I am a useful member of this community	**161**	6	22	51	38	44	3.7	13.7	31.7	23.6	27.3
I have the same values and beliefs as my neighbours	**153**	5	26	47	40	35	3.3	17.0	30.7	26.1	22.9
I feel I don't belong in this community	**159**	112	25	17	3	2	70.4	15.7	10.7	1.8	1.3
I am interested in what goes on in this community	**164**	8	13	29	56	58	4.9	7.9	17.7	34.1	35.4
I would be happy to leave this community	**158**	75	24	39	11	9	47.5	15.2	24.7	7.0	5.7
I know my neighbours and/or other community members	**164**	17	12	24	62	49	10.4	7.3	14.6	37.8	29.9
I have no active involvement in this community	**160**	48	31	33	28	20	30.0	19.4	20.6	17.5	12.5

Most people felt both at home and satisfied living in their community. People felt moderately useful and interested in their community and about a third felt that they knew their neighbours and community members. Few people felt that they would be happy to leave or like they did not belong. Overall, participants had positive feelings about the community they were living in.

41	**What are your main reasons for choosing to *live in* this community? (Choose the TWO most important reasons from the list below).**	
total n= 165	***n***	**%**
The natural beauty of the coast	97	58.8
Sea views	32	19.4
Escape from city life	69	41.8
Easy access to the beach	58	35.2
Fishing and shellfish gathering	8	4.8
Boating	7	4.2
Recreation (swimming, surfing, walking etc)	55	33.3
Sunbathing	4	2.4
Other	31	18.8

The main reasons given for choosing the community were due to the natural beauty of the coast and to escape from city life. Access to the beach, sea views, and recreation were also considered to be important. Of the "other" responses the most common were family, work and cost.

42	**How often do you visit this community? (Tick one only)**	
total n= 3	***n***	**%**
Very infrequently (once a year or less)	0	0.0
Infrequently (2-3 times per year)	0	0.0
Frequently (4-6 times per year)	1	33.3
Very frequently (at least 6 times per year)	2	66.7

All of the few visitors described the frequency of their visits as very often with four or more visits a year being usual. Two of the visitors are from Christchurch so such frequent visits would not be unusual and although the third is from Australia, he indicated that his reason for visiting was business.

43	What are your main reasons for visiting this community? (Choose the TWO most important reasons from the list below).	
total n= 3	***n***	**%**
The natural beauty of the coast	2	66.7
Sea views	1	33.3
Escape from city life	1	33.3
Easy access to the beach	1	33.3
Fishing and shellfish gathering	1	33.3
Boating	0	0.0
Recreation (swimming, surfing, walking etc)	0	0.0
Sunbathing	1	0.0
Other	1	33.3

Similar to permanent residents of the area the natural beauty of the coast was the biggest reason for choosing the community. There are, though, too many responses for the number of visitors because one of the visitors selected more than two reasons.

44	The following is a list of statement on how you feel about living in this community. Please use the scale below to show how much each statement matches your views. (Tick one per line) 1-Strongly disagree -– 5 – Strongly agree										
	n						**%**				
	T	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
I feel at home in this community	**166**	1	0	26	45	94	0.6	0.0	15.7	27.1	56.6
I know the neighbours	**164**	12	8	34	55	55	7.3	4.9	20.7	33.5	33.5
I am interested in community events	**163**	5	12	46	58	42	3.1	2.4	28.2	35.6	25.8
I am interested in local environmental issues (e.g. rubbish disposal, beach water quality)	**165**	3	6	27	57	72	1.8	3.6	16.4	34.5	43.6

This is very similar to question 39 and most likely was intended for only visitors to answer. The responses are again very positive.

45	Are you involved as a volunteer with any of the following in this community? (Tick all that apply)	
total n= 170	***n***	**%**
Fire brigade	0	0.0
Civil Defence	2	1.2
Search and Rescue	2	1.2
Surf Lifesaving	5	2.9
Rural fire patrol	0	0.0
Other	29	17.1

Not many participants were involved in any of the volunteer organizations. The largest response was in the other category, which included sporting clubs, coast guard and church organizations.

46	**Has your household done any of the following to prepare for a hazard or emergency? (Tick all that apply). If you are a *visitor* to this community, questions *46* and *47* apply to your usual home.**	
total n= 169	***n***	**%**
Have a working flashlight	141	83.4
Protected breakable household items	19	11.2
Put strong latches on cabinet drawers	13	7.7
Stored hazardous materials safely	74	43.8
Added edges to shelves to keep things from sliding off	4	2.4
Strapped water heater	39	23.1
Installed flexible tubing to gas appliances	7	4.1
Bolted house to foundation	30	17.8
Stockpiled water and food for three days	97	57.4
Have working portable radio and spare batteries	104	61.5
Have a working fire extinguisher	72	42.6
Have a working smoke detector	146	86.4
Have a first aid kit	141	83.4
Stored wrench near gas turn-off valve	4	2.4
Picked an emergency contact person outside your local area	32	18.9
Someone in family has learned how to put out fires	76	45.0
Bought additional insurance (e.g. home)	62	36.7
Someone in family has learned to provide first aid	99	58.6
Found out if you are in an area particularly vulnerable to a disaster (such as an earthquake, flood or tsunami)	86	50.8
Have had home inspected for preparedness	4	2.4
If a you are a visitor have you checked for emergency supplies where you are staying	2	1.2
Talked to family members about what to do if a tsunami hazard warning is heard	55	32.5

The most common emergency supplies that respondents had were a working smoke detector, a fist aid kit, and a working flashlight. It was also quite common for participants to have a working radio, a stockpile of food and water, for someone to have learned first aid and how to put out fires, and to discover if they were in an area particularly vulnerable to disaster. The least common preparedness measures seen are those that require greater expense and effort including having the home inspected for preparedness, putting latches on doors, adding edges to shelved, bolting houses to the foundation, and strapping water heaters. Although there was low indication of people having taken preparatory measures in regards to gas stoves, such as storing a wrench

nearby, this is from fewer respondents having gas utilities. Most participants indicated N/A next to gas related questions.

Although only two people indicated that they had checked their emergency supplies at the location they were staying while visiting this is due to the low number of visitors that were surveyed.

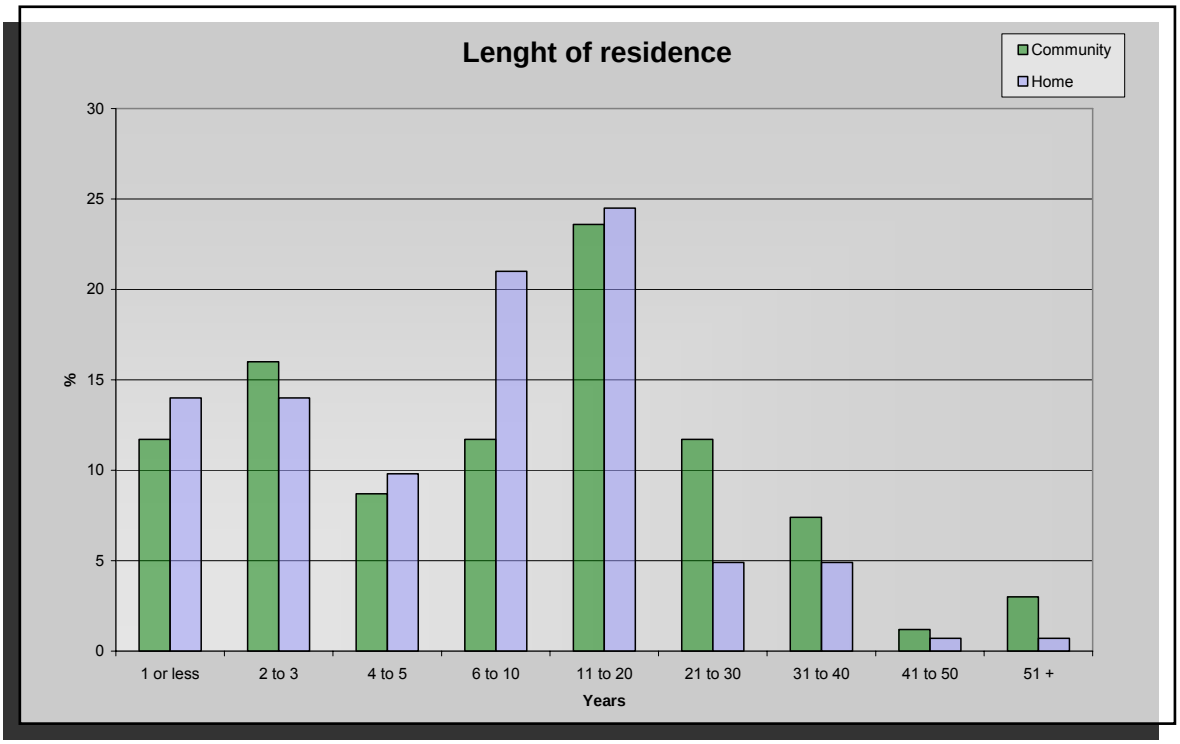
47	**How often do you check your emergency supplies like food, water, and batteries? (Tick one only)**	
total n= 162	***n***	**%**
Weekly	12	7.4
Monthly	55	34.0
Yearly	40	24.7
Never	50	30.9

The largest percent of participants checked their emergency supplies on a monthly basis, though almost as often supplies were never checked. Very few people, less than 7 percent, checked items on a weekly basis.

48	**If you are visiting this community, where is your usual place of residence?**
Avonhead, Christchurch	
Patons Rock, Takaka, Golden Bay	
Sumner, Christchurch	

Very few respondents were visitors, two out of three of which, were from Christchurch.

49	**If you *live* in this community:**					
		n	**avg. (yrs)**	**σ**	**min**	**max**
a) How long have you lived in this community		**162**	14.4	13.8	.1	70
b) How long have you lived in your current home		**143**	10.6	10.4	.1	55



There was great variation in length of residency, from recently moved to the community to long-time residents. The mean average time in the community was approximately fourteen years while the median average was a similar eleven years. The typical time at their current home was slightly less at ten years for the mean average and eight for the median.

51a	**Did you complete the 2003 coastal survey?**	
*total n= 144**	***n***	**%**
Yes	61	42.4
No	71	49.3
Don't know	12	8.3

Although a few people were unsure, it was nearly even between those that had filled out the survey in 2003 and those that had not. However about 37 participants had moved to the community since the 2003 survey was conducted and therefore most likely would not have had the chance to participate in the previous survey. * This question was added to the survey with a sticker after printing and was left off approximately 17 questionnaires. All surveys that were missing this question were sent to the community of Pareora, which was not surveyed in 2003.

4.5 Discussion

Altogether, there was generally a high level of awareness on basic tsunami information such as the most common generation mechanism, how the tsunami waves occur, and when the last tsunami was. Awareness on more specific issues was considerably lower, however, including the amount of time they would have; with most people underestimating the amount of time they would have to move to safety after both a distant and local source tsunami. Additionally there was a wide distribution of expected sources of information and warnings during a tsunami and a wide range of responses on how they would react during a tsunami.

Higher perceived risk tends to lead individuals to take preparatory measures (Leonard *et al,* 2004; Weinstein, 1989). Although a high percentage of participants noted that they lived in an inundation zone and they considered tsunamis to be a likely threat, preparatory measures were generally low. The majority of respondents viewed preparation as effective in saving lives and as a means to improve their ability to deal with disruption to their family and communities, however, most individuals reported that they did not have an emergency plan or an emergency pack ready. Most households had taken some general emergency preparedness measures, such as having flashlights, smoke detectors, first aid kits and portable radios and having knowledge of first aid and fire safety. However, these measures can be seen as routine methods of providing for the general safety of the family, rather than as a means to prepare for possible natural hazards (Johnston *et al,* 2002). Preparedness levels may be even lower that indicated because the overall demographic skew towards the socially empowered and financially more secure can lead to an overestimation of preparedness levels (Leonard *et al*, 2004).

There are many reasons that individuals to not take steps to prepare for hazards even though they are aware of the hazards and perceive risk from it. Often times low levels of preparedness can be attributed to a lack of salience, with daily life taking priority (Drabek, 1986) or the degree of difficulty in adopting a given measure (Paton, 2003). Short length of residence in the community or individual dwelling can also inhibit preparedness. Individuals require time to make contacts in the community, form social groups, develop their knowledge about local hazards and then make

preparatory adjustments to those hazards (Leonard *et al,* 2004). Over half of respondents, though, had lived in their home and community for over five years, which is sufficient time to have taken preparedness measures. Whether an individual owns or rents their residence can also affect willingness to prepare. Renters can be less likely to adopt some measures because they may not be allowed to make structural changes such as securing furniture or water heaters due to their lease agreements. Additionally, they may not see themselves as having a vested interest in doing so because of either the temporary nature of renting (Leonard *et al,* 2004) or lack of personal responsibility in making permanent improvements to the property. This does not account for the lack of preparedness amongst those surveyed, though, because over 80% of respondents were homeowners at their primary residence.

Chapter 5

Variations in Risk Perception between Residents and Visitors

5.1 Introduction

Populations of coastal areas undergo a great increase during the summer season due to the influx of tourists. This increase in population increases risk from tsunamis by exposing more people who are less likely to be aware of local hazards and how to respond to them (Alexander, 2002). Residents tend to be more informed and have more experience whereas tourist have lower risk perceptions, and will be less likely to make appropriate decisions regarding self-protective actions (Drabek, 2000). Surveying was undertaken during the peak summer months to ascertain tourist views of tsunami hazards. This was later followed up by a residential survey. Comparison of these surveys can reveal the differences in perception and knowledge between these two groups.

5.2 Risk perception

5.2.1 Introduction

Individual's ideas about risk are quite different from that of professionals' (Slovic, 2000; Kates *et al,* 1993; Kasperson *et al,* 1988; Burton and Kates, 1964). Professionals use risk analysis, the measurement of risk using the factors of magnitude of the potential loss L, and the probability p that the loss will occur (Wikipedia, 2007) to determine the level of risk posed by natural hazards, whereas this process for the average individual relies more on their instinctive reasoning or their innate judgement of risk referred to as their risk perception (Slovic, 1987; Slovic, 2000). Moreover, professional often determine risk by estimating probably mortalities (Covello, 1983; Lindell and Perry, 1992) which does not factor highly into individual's perception of risk (Lindell, and Perry, 1992; Slovic, 2000).

Risk perception results from a combination of social and cultural processes through which hazards are understood (Zschau and Küppers, 2003). "Community emergency planners are most likely to be successful in gaining compliance with their recommendations for protective actions if they understand how those who receive their warning messages interpret the information provided" (Lindell and Perry, 1992). The affects of natural hazards can be greatly amplified if the at risk population does not believe in the possibility that such an event will occur and therefore does not take preparatory measures (Burton and Kates, 1964). Experience, the media and demographic factors are some of the variables that affect people's risk perception.

5.2.2 Experience

In general, experience with a hazard will increase the risk perception (Kasperson *et al,* 1988) by increasing awareness of the event (Baker, 1991). People with personal experience are more likely think of the risks more often, to be able to recognize the risks associated with a hazard, to see hazards as occurring more frequently, to view themselves as potential victims, and are therefore more likely to take preparatory measure for the future (Weinstein, 1989). Although many studies have positively linked an increase in perceived risk with experience (Weinstein, 1989, Saarinen, 1982) for natural hazards this increase may only be short-lived and may relate to the severity of the experience (Weinstein, 1989), the more severe the longer it is remembered. Risk perception is affected more by regular and repeated experience than with single occurrences. Even experience with a false alarm, where an unnecessary evacuation has occurred, can lead to an increase in risk perception (Vogt and Sorensen, 1992) and as long as the reasons for the evacuation are presented to the public this will not decrease willingness to evacuate in the future (Vogt and Sorensen, 1992; Dow and Cutter, 1998; Lindell and Perry, 1992).

Experience, however, does not always increase perceived risk. Individuals who have experienced minor effects that are considerably smaller than what can potentially occur from a hazard will feel that they have had experience with the hazard. This is referred to as "false experience" (Baker, 1991) or a "normalisation bias" (Johnston *et al,* 1999; Johnston *et al*, 2002; Leonard *et al,* 2004). This commonly occurs with hurricanes during which those who were on the fringes of the

storm or have been through a minor one feel that they have experience what a hurricane is like (Drabek, 1986; Baker, 1991; Weinstein, 1989; Lindell and Perry, 1992). Those with false experience will have a lower risk perception than those without, especially because individuals often assume that the next occurrence of the hazard will have the same severity as the last one (Weinstein, 1989). Long-time residents of an area are more likely to have false experience and therefore can have lowered risk perception (Baker, 1991).

On the other hand, people who have experienced relatively small hazards events will sometimes overlook there experience altogether, only considering experience that has involved fatalities or damage (Gregory *et al,* 1997). This will also lead to a lowering of risk perception with individuals believing that the hazard has never occurred in their location.

Another effect of experience is that once a rare or low-probability event has occurred, residents will believe that it will not happen again, exemplifying the attitude that "lighting never strikes the same place twice" (Drabek, 1986; Lindell and Perry, 1992; Burton and Kates, 1964) or that the odds are that it will not occur again for a long time (Lindell and Perry, 1992).

5.2.3 The media

Since risk from natural hazards rarely includes experience with the actual hazard (Rogers, 1997) individuals commonly learn of risks from media sources (Slovic, 2000; Kasperson *et al,* 1988) such as television, radio and newspapers. In fact, in one report 60 to 75% of respondents had indicated that radio and television were important sources of hazard information and sometimes these were the only sources (Drabek, 1986).

So to what degree does the media affect the way risks are perceived? It has been described of the media that by selecting, emphasizing, and arranging the information it conveys to the public the media constructs reality instead of merely reflecting it and it presents a superficial and fragmentary viewpoint (Singer and Endreny, 1993).

By choosing what information to present and what emphasis to place on it, the media has a definite influence on public risk perception. Generally, people

overestimate risks from well-publicised hazards and underestimated the likeliness of those that are underreported or not reported at all (Singer and Endreny, 1993). A particular example is the fear of radiation from nuclear power plants, which the publics' perceived risk of is disproportionately high compared to experts (Slovic, 1987; Slovic 2000; Kasperson *et al,* 1988). The Three Mile Island and Chernobyl accidents have substantially increased the risks associated with nuclear power and over-dramatized headlines afterwards "certainly increased public fears near the nuclear power plant (and around the world)" (Slovic, 2000).

Although the media is supposed to report facts after an event in an unbiased manner a number of factors affect how and what are actually reported. Audience interests, deadlines (Singer and Endreny, 1993), cultural biases, and profit (Miles and Morse, 2006) influence media coverage to varying degrees. Media often overemphasises the dramatic giving more coverage to rare events or those with higher fatalities (Singer and Endreny, 1993; Slovic, 2000). This can lead to media hypes, giving more and more attention to unusual events (Miles and Morse, 2006).

The media can also skew views on risk from inaccuracy or distortion in reporting (Slovic, 2000). Reporting errors can occur from attempting to present technical information in a more easily understood manner (Miles and Morse, 2006) omissions of facts or overgeneralization in order to shorten reports, alterations or distortions used for emphasis, or outright errors (Singer and Endreny, 1993).

5.2.4 Demographic factors

Gender

It is well documented that there are differences in risk perception related to gender (Slovic, 2000; Riad *at al*, 1998; Bateman and Edwards, 2002; Drabek, 1986). In general, men tend to perceive less overall risk or to judge risks as smaller. Women, on the other hand, are more likely to perceive disasters as serious or risky (Bateman and Edwards, 2002; Riad *et al*, 1998).

There are a number of social reasons given for females being more risk averse and having higher perceived risks than male. One of the reasons is that women are considered to be socially conditioned towards having a nurturing attitude, leading them to be more concerned about health and safety issues (Slovic, 2000).

Also women are seen as being "risk avoiders" whereas males are considered to be "risk takers" (Bateman and Edwards, 2002). This can be attributed to the fact that men and women occupy different societal positions of authority. Men perceive less risk than women because they "more often feel empowered and in control" whereas the opposite holds true for women (Bateman and Edwards, 2002). Males were also more likely to have higher levels of education and income (Slovic, 2000), which tends to add to feelings of security and reduce feelings of vulnerability.

Ethnicity

This is not as well studied as gender differences and risk perception and findings have been somewhat inconclusive because of the many other factors that determine an individual's perception of risk (Drabek, 1986). Overall, minorities experience higher perceived risks especially in comparison to caucasian males (Slovic, 2000). Ethnic minorities are in the same societal position as women and are more likely to feel a lack of control and power, which leads to feeling more vulnerable, and a heightened sense of risk (Bateman and Edwards, 2002).

5.2.5 Other factors

Many other factors have been suggested to have some influence on perceived risk, although there is not detailed documentation on how. These include controllability, (Slovic, 2000; Covello, 1983), age, residential setting (Drabek, 1986), dread, potential for mass fatalities, personal exposure, hazards with unknown risk, new risks (Lindell and Perry, 1992), familiarity with the hazard, voluntariness of the hazard, hazards with delayed consequences, potential to affect future generations, and potential for catastrophe (Slovic, 2000; Covello, 1983; Lindell and Perry, 1992).

5.3 Natural hazards and the tourist industry

The tourism industry is sensitive to the impact of natural disasters and as one of the world's largest economic sectors (WTO, 2006) much of the literature in regard to tourism and natural hazards focuses on recovery of the industry after an event (Pottorff and Neal, 1994; Huang and Min, 2002; Milo and Yoder, 1991; Durocher, 1994; and Barton, 1994). And although, there is a growing body of literature on disaster planning and evacuating for the industry (Drabek, 1993; Drabek, 1995a; Murphy and Bailey, 1989; and Barton, 1994) there is little regarding tourist behaviour (Drabek, 1996) or perception of hazards (Johnston *et al,* 2005). There is a definite need for incorporating non-residents requirements into disaster planning (Murphy and Bailey, 1989) especially since a lack of planning has been exhibited by tourist industry executives (Drabek, 1995b). When it comes to natural hazards, though, tourists represent a particularly vulnerable group for several reasons.

Visitors often frequent exotic beachfront or mountainous locations that are susceptible to natural disasters (Murphy and Bailey, 1989; Faulkner, 2001). Yet tourists, who are often unfamiliar with the locations they visit, are also unlikely to be aware of the potential hazards (Drabek, 2000, Alexander, 2002; WTO/WMO, 1998; Faulkner, 2001, Murphy and Bailey, 1989) let alone what to do during a disaster or how the warning systems work. Johnston *et al* (2005) surveyed both visitors and residents of coastal Washington communities where extensive public education on tsunamis including warning and evacuation signs (figure 5.1), public displays, books, pamphlet and school kits, has been ongoing for many years. While these efforts had been moderately to highly effective amongst residents, Johnston *et al* (2005) found that tourist knew less about the hazard and warning systems and overall were less aware about tsunami issues. While approximately three quarters of residents had heard or received information on

Figure 5.1: Tsunami warning sign such as those used in the Washington state public education program (Atwater *et al,* 2005).

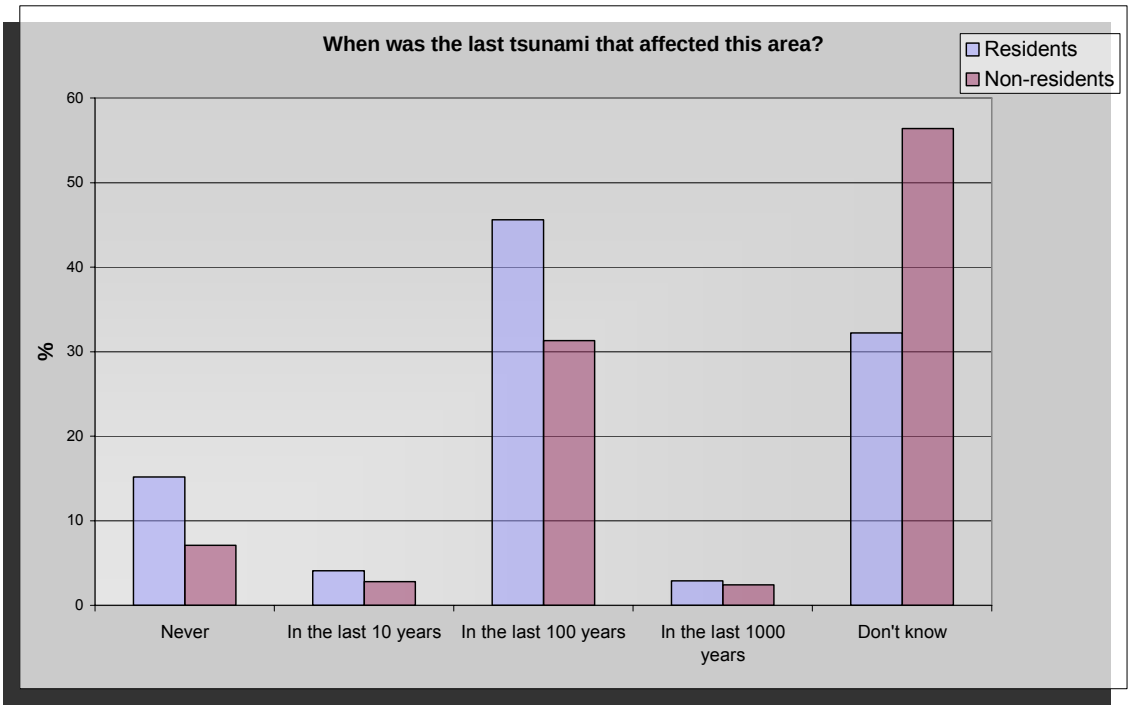
tsunamis and almost two third had seen hazard zone maps less than 50% of visitors had heard or received information and less than 20% of non-residents had seen hazard zone maps (Johnston *et al*, 2005)

This vulnerability of tourist is exacerbated by the lack of disaster planning and preparedness of businesses in the tourism industry. In his survey of 185 executives in the tourism industry Drabek (1995a and 1995b) found that although there had been some degree of planning it was mostly informal with very few, about a quarter, having actual written plans. In another study, Drabek (2000) noted that visitors had higher expectations of accommodations personnel than the managers/owners were willing or able to provide including that they should have written disaster plans that incorporated the needs for disabled individuals or those with language barrier issues. The individuals surveyed by Drabek (2000) also believed that there should be training exercises for staff and disaster brochures available in their hotel rooms, though most hotel managers believed that these options were either not viable or that they would intimidate customers. It is important, though, for managers and staff to understand the nature of hazards and to have plans in place, because they are often the first source of information for tourist or when the media is the first source individuals will often seek to confirm the information with accommodations operators (Drabek, 2000).

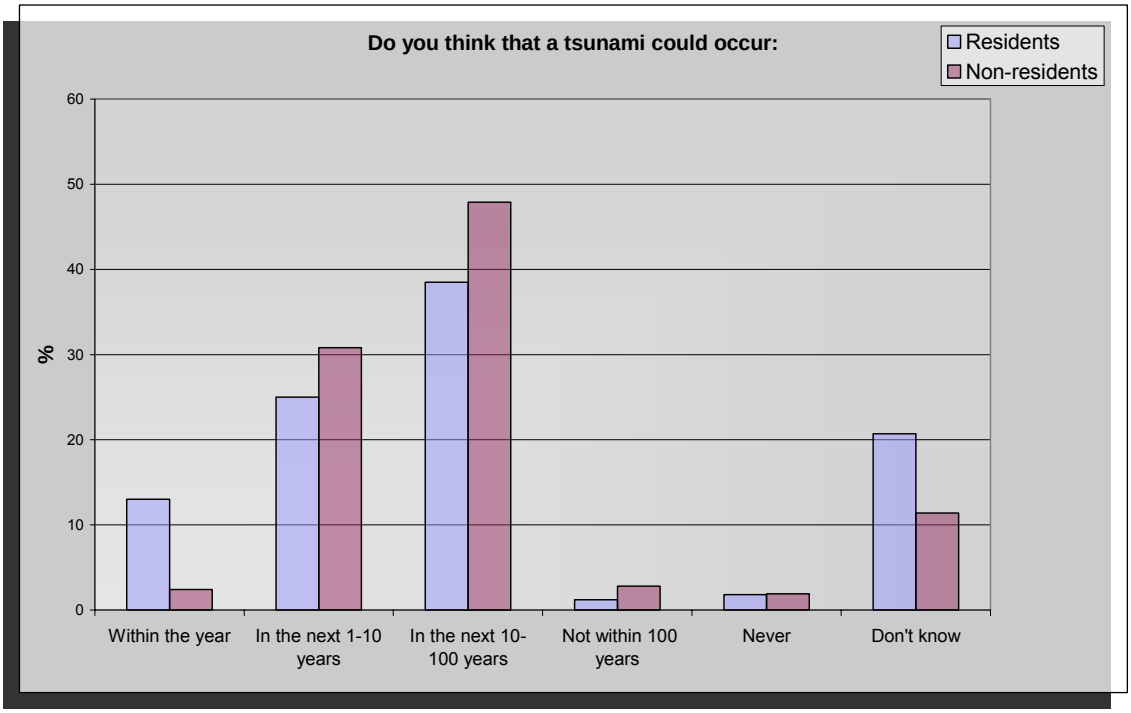
This reliance on accommodations operators to be informed and prepared reduces the ability of tourist to act independently and to react appropriately during a hazard. By placing the burden of responsibility on the tourism industry tourists remove the need to prepare for or to consider possible hazards, in effect almost removing the perception of risk from their concern.

5.4 Residents and non-residents- the results

5.4.1 General tsunami knowledge



Between residents and visitors, visitors were more likely to say that "don't know" which almost twice as many visitors indicated. The last tsunami that had any significant impact in the Canterbury region occurred in 1960 (see Chapter 2). More residents than visitors knew that there had been a noteworthy tsunami in the last 100 years. Although contrarily, slightly more residents believed that a tsunami had never affected the area.



More residents believed that a tsunami was likely to occur with-in the year than non-residents, though visitors were more inclined to believe that one would occur with-in one to ten years. However, the majority of those surveyed, of both groups, indicated that a tsunami would be more likely in the next ten to one hundred years. This shows that although it is believed that a tsunami is likely to occur in the future it is generally thought of as not an immediate threat. Those who believe that a tsunami is imminent are more likely to engage in preparatory measures.

5.4.2 Information Sources

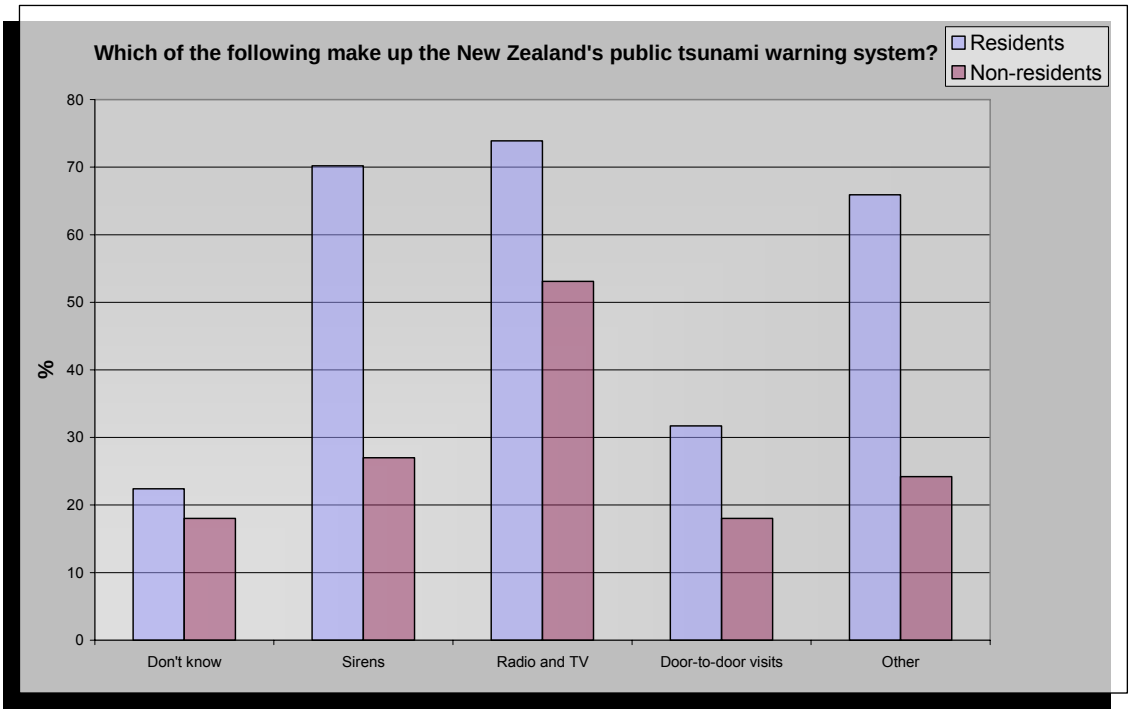
Have you heard or received information about preparing for tsunami hazards from any of the following? (Tick all that apply)		
	Non-resident	***Resident***
Friends or family	17.5	20.4
Central Government	2.8	8.5
Region Council	1.0	15.5
Local Council	2.4	19.7
Local Civil Defence group	16.1	26.1
Business establishments	1.0	0.7
Research Organization	1.0	12.7
My child's school	5.7	3.5
Other	24.2	25.3

Fewer visitors indicated that they had received information from all sources that had residents. Bothe residents and non-residents more commonly indicated that they had heard or received information from friends or family and Civil Defence. Residents, though, were more likely to have received information from Local and Regional Councils and research organizations.

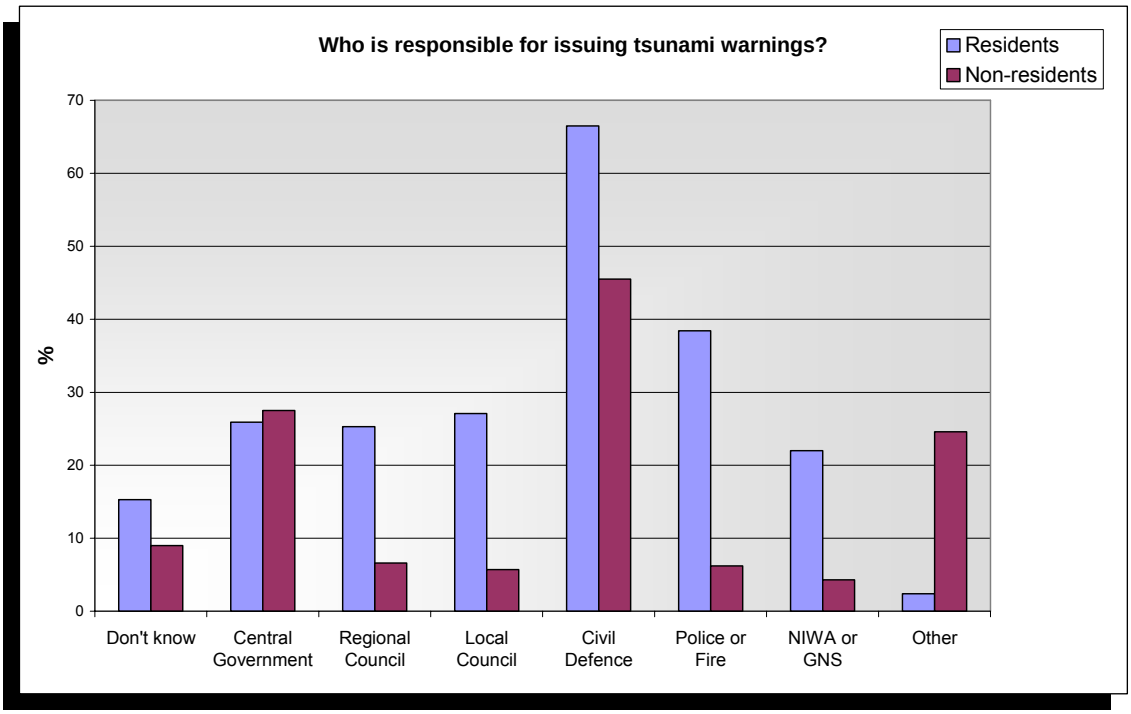
Have you asked any of the following people, groups or organisations for information on how to get ready for tsunami hazards? (Tick all that apply)		
	Non-resident	***Resident***
Friends or family	1.0	11.2
Central Government	1.0	0.7
Region Council	0.0	1.4
Local Council	0.0	0.7
Local Civil Defence group	1.0	4.9
Business establishments	0.0	0.7
Research Organization	0.0	1.4
My child's school	0.0	1.4
Other	0.0	5.1

Again, non-residents were less likely to have asked for information from almost all sources. Very few non-residents had engaged in active information seeking, only 3% of those surveyed, whereas almost 30% of residents had.

5.4.3 Tsunami warnings

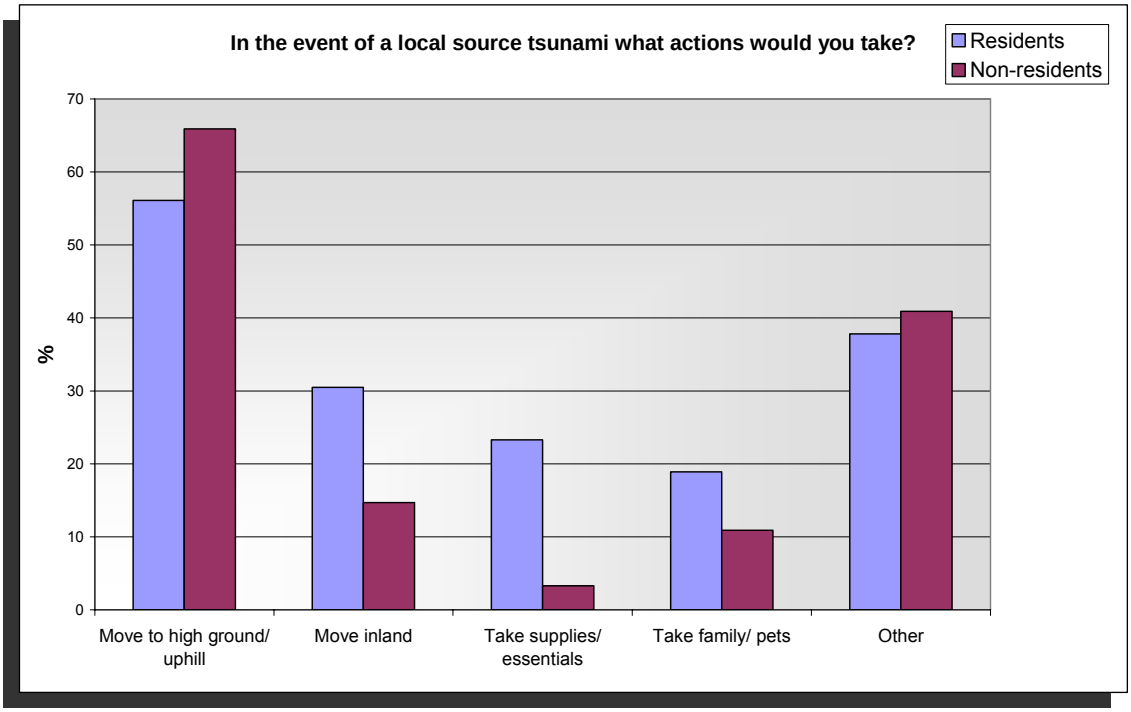


Residents had a tendency to select many or all options as being part of the public warning system (although some options are not shown since they were not given as an option in the non-resident survey), whereas the non-resident survey was conducted as an interview and participants were more likely to indicate only one or two options. This accounts for why all options are higher for residents. The majority of both residents and visitors believed that tsunami warnings would come from radio and TV broadcast. Residents, though, rather erroneously had a high expectation of warning via siren.



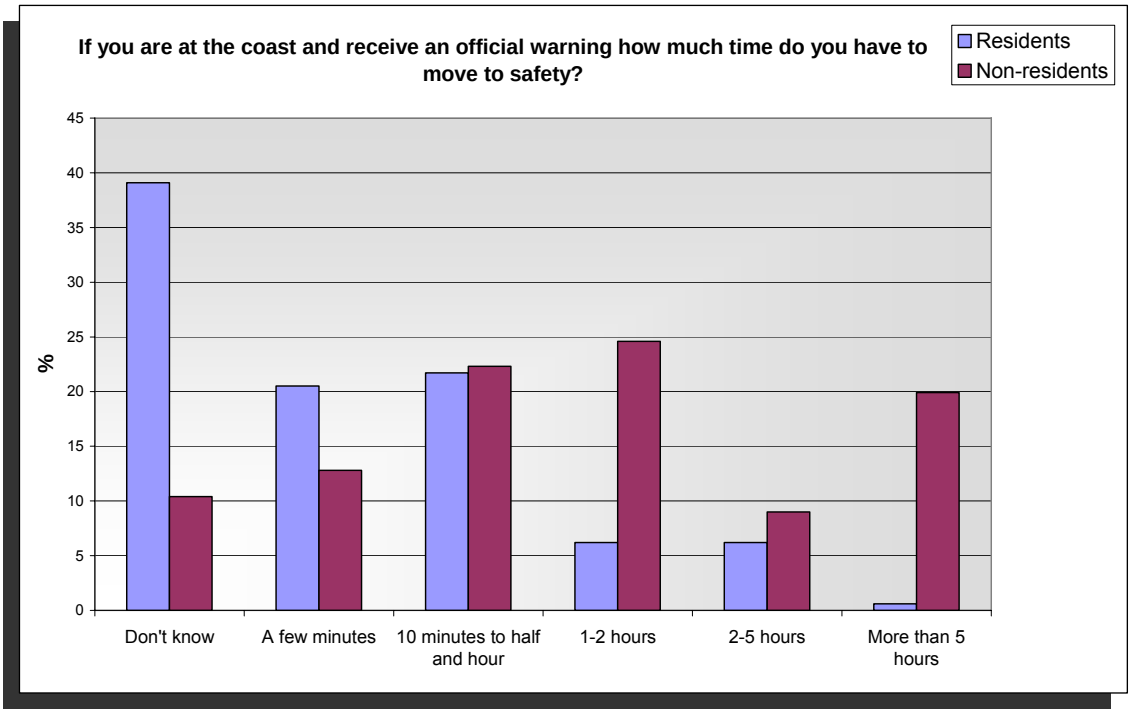
Again, residents indicated that most of the listed organizations were responsible for issuing warnings. Non-residents were more likely to indicate that Central Government was responsible for issuing warnings whereas residents more commonly chose local organizations such as Civil Defence and police or fire services. Non-residents also had chosen "other" more frequently, commonly specifying international organizations or the Pacific Tsunami Warning Center most often.

5.4.4 During a tsunami

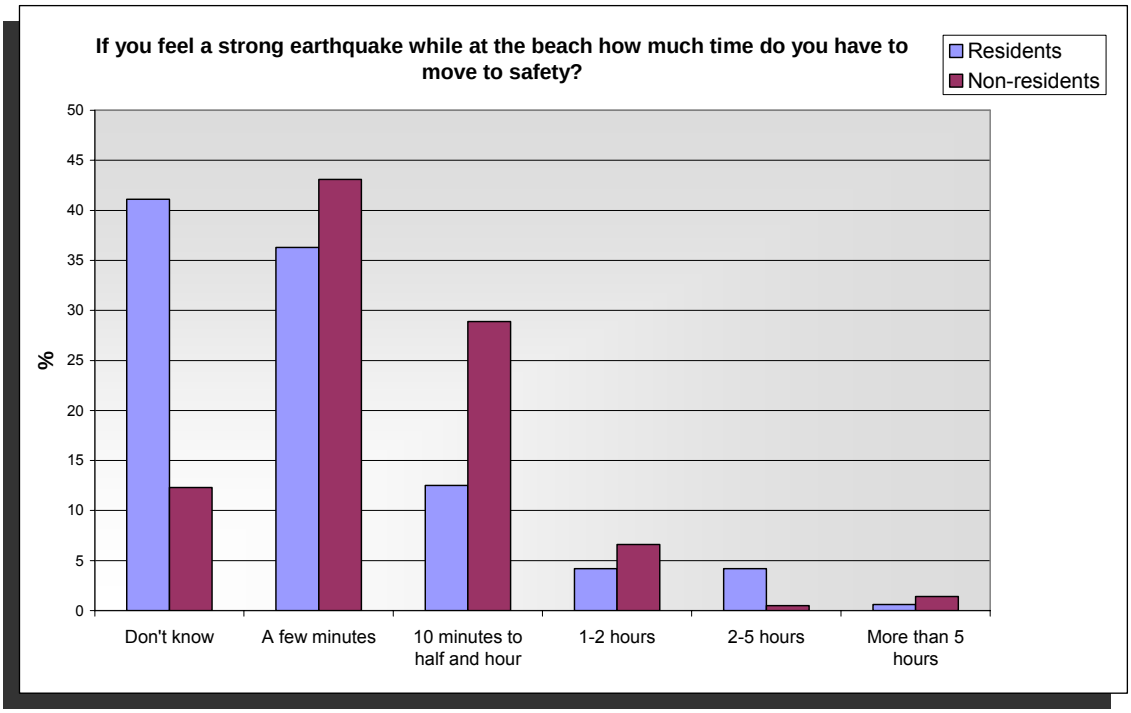


The majority of both residents and non-residents responded that they would move uphill or to high ground in the event of a locally generated tsunami. Taking supplies was indicated more often for residents as was taking family or pets.

Actions for a distant source tsunami are not examined here because the residential survey asked how participant's actions for a distant source would differ from that of a local source tsunami, while the visitor survey asked what actions they would take. Most visitors indicated the same response or though some said that they would take more supplies. This was a similar response to that of residents, although residents more frequently said that they would pack more supplies.



Residents were more likely to respond that they did not know how much time that they would have to move to safety or that they had only a few minutes to half and hour after an official warning. An official warning would be given after a distant source tsunami only, since there would insufficient time to issue a warning after a local source tsunami. This would most likely be a tsunami coming from South America which would take approximately 12-14 hours to travel to New Zealand, in which case a warning would be issued with at least three hours to move to safety till the tsunami impacted (see Chapter 2). More visitors chose longer times with the majority indicating 1 to 2 hours.



Although more residents indicated that they did not know how much time they had to move to safety after an earthquake both residents and non-residents were correct in responding that they did not have a great deal of time to do so, under half an hour.

5.6 Discussion

Visitors knew less about general tsunami information such as when the last tsunami occurred and were less likely to believe that a tsunami could occur imminently. Non-residents reported less receipt of information and did considerably less information seeking. Differences in knowledge of warning systems were difficult to ascertain because residents had higher percentages of almost all selections. Residents were also more likely to indicate that they did not know how much time they would have to move to safety during a tsunami and both residents and visitors were equally aware of the proper actions to take in the event of a tsunami.

These results may be because over 90% of holiday park visitors surveyed were local rather than national or international visitors. For a better view of visitors' perceptions surveying hotels and hostels would prove more accurate, since these accommodations are more likely to have international guests.

Chapter 6

Changes in Hazard Perception since the 2004 Boxing Day Tsunami

6.1 Introduction

The 2004 Boxing Day tsunami has been referred to as a "megatsunami" (Synolakis and Kong, 2006; Synolakis *et al,* 2005) a "megadisaster" (Iwan, 2006) and "the most devastating tsunami in modern history" (Titov and Arcas, 2005). By some accounts, the death toll for this single event was higher than all other tsunamis in the last 300 years, put together (Synolakis *et al*, 2005).

Infrastructure in some locations was completely devastated (Saatcioglu et al, 2006a) including the destruction of many coastal villages, lifelines were significantly disrupted (Scawthorn *et al,* 2006) and even now the economy continues to suffer from impacts on the tourist industry, a major source of income for the region (Birkland *et al,* 2006). It will be years before the areas that were directly affected fully recover, but the tsunami had further reaching effects than just the physical and economical ones.

This tsunami had impact on a global scale. In an interview after the event, it was quoted that "Before December 25, very few people knew what a tsunami was. After December 26, almost everyone does" (Lautenbacher Jr., 2005). Such a large scale and devastating natural disaster can affect worldwide perceptions of tsunami hazards, how they are viewed and what is known about them, motivates law changes, and can brings about advancement in the sciences.

6.2 The 2004 Sumatra-Andaman Earthquake and Boxing Day Tsunami

6.2.1 The earthquake

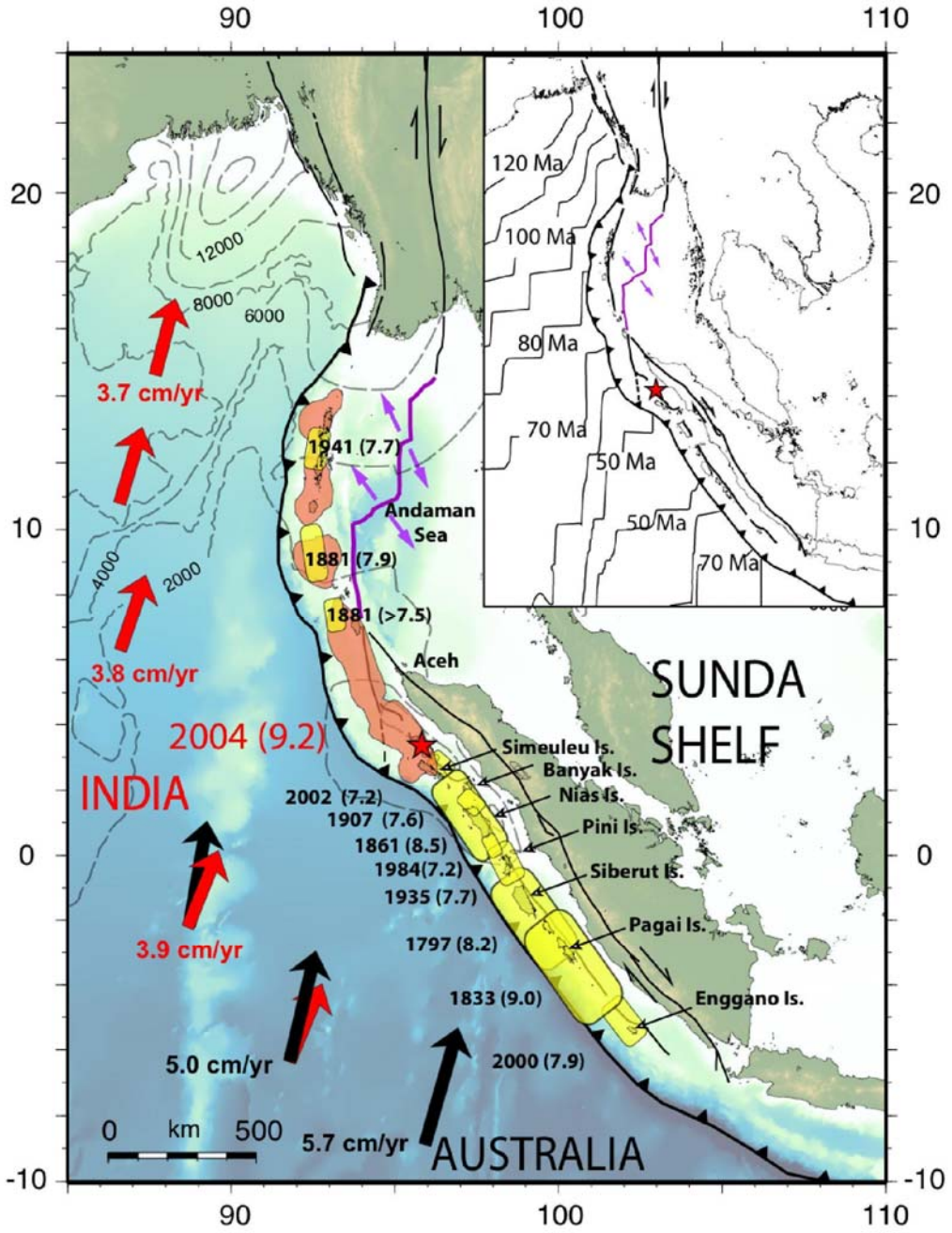


Figure 6.1: The Sunda plate boundary and plate motion, ages, dates and Richter magnitudes of ruptures that have occurred. Red arrows are plate motion for India and black are for Australia. Yellow areas are earthquake zones and orange areas are zones where greater than 5 meters of slip have occurred (Hudnut, 2006).

At 7:58 am local time or 58:50 UTC, approximately 160 km west of Sumatra (Wikipedia, 2006) the boundary between the Indo-Australian and the Eurasian plate (figure 6.1) ruptured in what was one of the largest instrumentally recorded earthquakes ever (Iwan, 2006). Initially recorded at Richter magnitude 9.0, the magnitude was later revised to 9.3. The quake was felt as far away as Bangladesh, India, Malaysia, Myanmar, Thailand, Singapore and the Maldives (Wikipedia, 2006). Prior to this event, large quakes, of up to magnitude 9, had been produced on the southern portion of the fault. This earthquake was produced in a region that was known for slower plate motion and smaller events (Geist *et al*, 2006). In the week following the earthquake stress redistribution on the fault was responsible for 13 aftershocks between magnitude 6.0-7.1 and numerous smaller ones (Waltham, 2005).

The slip occurred over about a 1,200 km (Kanamori, 2006; Stein and Okal, 2005; Wikipedia, 2006; Geist *et al,* 2006) to 1,600 km (Hudnut, 2006) length of fault in at least two separate movements (Wikipedia, 2006) which cascaded northward from the original rupture location (Hudnut, 2006). As the slip progressed northward it slowed and it is conjectured that this later slow slip may have amplified the resultant tsunami (Stein and Okal, 2005).

6.2.2 The tsunami

Hundreds of cubic kilometres of seawater were displaced as a result of the three (Waltham, 2005) to eight meters (Geist *et al,* 2006) of vertical offset produced by the earthquake. At least 16 countries were affected directly by the resulting tsunami (figure 6.2) including Indonesia, Malaysia, Thailand,

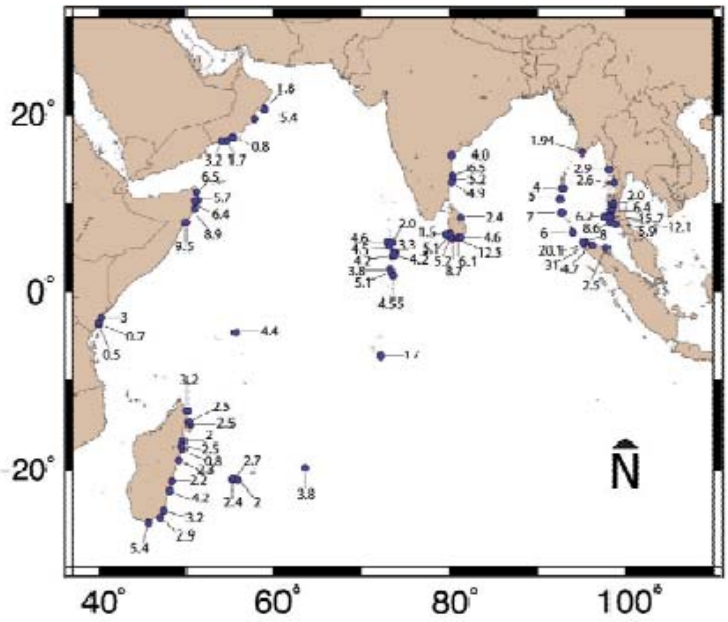


Figure 6.2: Reported run-ups from around the Indian Ocean basin from the Boxing Day tsunami (Synolakis and Kong, 2006).

Myanmar, India, Sri Lanka, Oman, Somalia, Kenya, Tanzania, Madagascar, the Maldives, Rodrigues, Mauritius, Reunion, and the Seychelles (Synolakis and Kong, 2006).

Figure 6.3: The tsunami at Ao Nang, Thailand (Wikipedia, 2006).

Of these the first and hardest hit was Sumatra, where two waves were reported approximately 90 minutes after the quake (Synolakis and Kong, 2006). Waves, which were slowed to 30 to 40 kph, travelled 3 to 4 kilometres inland and run-up was recorded at over 30 meters in some locations in Aceh province (Geist *et al,* 2005) though 10 to 20 meters was more common.

Figure 6.4: Destruction of wooden buildings in Bandeh Aceh, Sumatra (Saatcioglu *et al,* 2006a).

After about two to three hours waves reached Thailand (figure 6.3), Sri Lanka, and southern India which all suffered damage similar to that of Sumatra (Waltham, 2005) even though wave heights were generally less than 10 meters (Synolakis and Kong, 2006). In most other locations run-up was not as extreme with wave heights averaging less than 5 meters (Synolakis and Kong, 2006).

Even though run-up heights were significantly less for other affected locations there was still considerable damage to infrastructure and lifelines. Drag and surge forces from a one meter tsunami can destroy even well-built houses (Berryman, 2005) and the predominantly non-engineered, low-rise, timber-framed buildings of the affected areas were easily overwhelmed (Saatcioglu *et al*, 2006a; Wyllie, Jr. 2006) which is why many coastal villages and hotels were completely destroyed (figure 6.4) (Waltham, 2005). Although masonry buildings frequently fared well during the earthquake, columns were broken and walls were perforated by floating debris during the tsunami. Reinforced concrete buildings, especially mosques, are the type that performed the best with many surviving both the quake and tsunami (figure 6.5) (Wyllie Jr., 2006).

Figure 6..5: A mosque located near the waterfront of Bandeh Aceh harbor which suffered some damage to exterior walls from debris but otherwise is mostly intact (Saatcioglu et al, 2006).

Although lifelines were disrupted, many of the lifeline supplies such as water, power and communications were located further inland (Ballantyne, 2006) and were therefore only minimally interrupted. And even though tens of thousands of wells were contaminated with debris and saltwater, portable treatment plants were brought in afterwards and the usual issues from contaminated water, such as epidemics, did not occur. Power poles were often knocked down, but plants were usually located far enough inland to not be affected (Ballantyne, 2006). There was considerable damage to bridges and roads, which made rebuilding, and delivery of aid supplies afterwards a monumental task (Waltham, 2005). There was extensive damage to ports, harbours (figure 6.6) and boats, although

Figure 6.6: Damage to the harbor at Khao Lak (Saatcioglu *et al,* 2006b).

seawalls reduced the impact to some facilities (Ballantyne, 2006). In many locations damage was increased because protective features such as mangroves and dunes had been removed to improve beach views (Synolakis, 2006).

With billions of dollars worth of damage (Ballantyne, 2006), millions left homeless, and hundreds of thousands dead (Iwan, 2006; Waltham, 2005; Wikipedia, 2006; CRED, 2005), this was the single worst tsunami ever recorded. Yet because this was such a devastating event, and came at such a high cost, there is much that has been learned from it.

6.2.3 Tsunami science since Boxing Day- lessons learned

The Boxing Day tsunami greatly improved our understanding of tsunamis and a number of important observations were made during the event. One of the most important is that this was the first time instrumental readings had been taken of a tsunami traversing the open ocean. These came from a group of satellites that passed over the Indian Ocean between two and nine hours after the earthquake adding images and altimetry readings to verify what were previously just models (Synolakis, 2006) from near shore tide gauges measurements (Geist *et al,* 2006). They confirmed that tsunami waves in the open ocean are indeed relatively small (~half meter high) waves (Geist *et al*, 2006). There were also several other phenomena that were identified during the Boxing Day tsunami (Synolakis, 2006).

One of these is the guiding effect of mid-ocean ridges which funnelled the tsunami away from the tip of Africa (Synolakis and Bernard, 2006).

There was also the fact that the Maldives were relatively unscathed from the tsunami even though they rise only 2 meters above sea level. Usually tsunamis are amplified from the small wave that is seen in the open ocean to the larger devastating wave when it reaches shallow water. Since the Maldives rise as “pillared structures” from the ocean floor they did not experience this amplification effect (Synolakis and Bernard, 2006). Although this it had been previously theorized, this was the first time it had been observed (Synolakis and Bernard, 2006).

Another important observation from the Boxing Day tsunami was the location from which it originated. The event was produced from a location previously thought unable to generate tsunamis because the plate was characterized by slow motion. New

locations are now being analysed with respect to their potential for generating tsunamis (Geist *et al*, 2006).

However, lessons learned from this extreme natural hazard were not just to the scientific community and the affects were not just physical and economical. Change in awareness and perception of tsunami hazards is also expected.

6.3 Hazard perception and catastrophic events

When large-scale disasters affect a large number of people society reacts in a number of ways including rapid dissemination of information through the media, government agencies taking mitigation measures, recovery services provided afterwards for victims, and social networks communicating information about risks and reduction methods (Weinstein, 1989). These all contribute to how risk from natural hazards are perceived.

Individual risk perception "rests on a foundation of experience" yet perceived risk from natural hazards rarely includes experience with the actual hazard (Rogers, 1997), especially when dealing with low probability, rare occurrence events such as tsunamis. Such extreme events are less likely to impact perceived risks than those that occur more frequently and will only affect perceived risk as a result of extreme consequences (Rogers, 1997) including high death tolls and large economic losses. There is, however, little in the literature regarding how perceived risks change after such large-scale, low probability events (Rogers, 1997). Increased awareness and knowledge of the hazard would be expected especially during the period immediately after an event because of the intense media coverage that usually follows such catastrophes. A method to determine whether perception does change would be to survey people prior to and after such an event. The difficulty with this approach is that the low occurrence of the hazard requires almost random surveying of potentially at risk communities before a disaster happens. Although comparison survey before and after large-scale disasters are lacking the same increase in awareness and risk perception are expected for smaller scale events. Johnston *et al* (1999) surveyed two New Zealand communities before and after the 1995 eruption of Raupehu. Both communities had received extensive media coverage during the eruption, while only one had experience direct effects of the eruption. Johnston *et al* (1999) found that the

community that had been affected by ash fall had a significant increase in risk perception and personal vulnerability in regards to volcanic hazards whereas there was no considerable change for the other community.

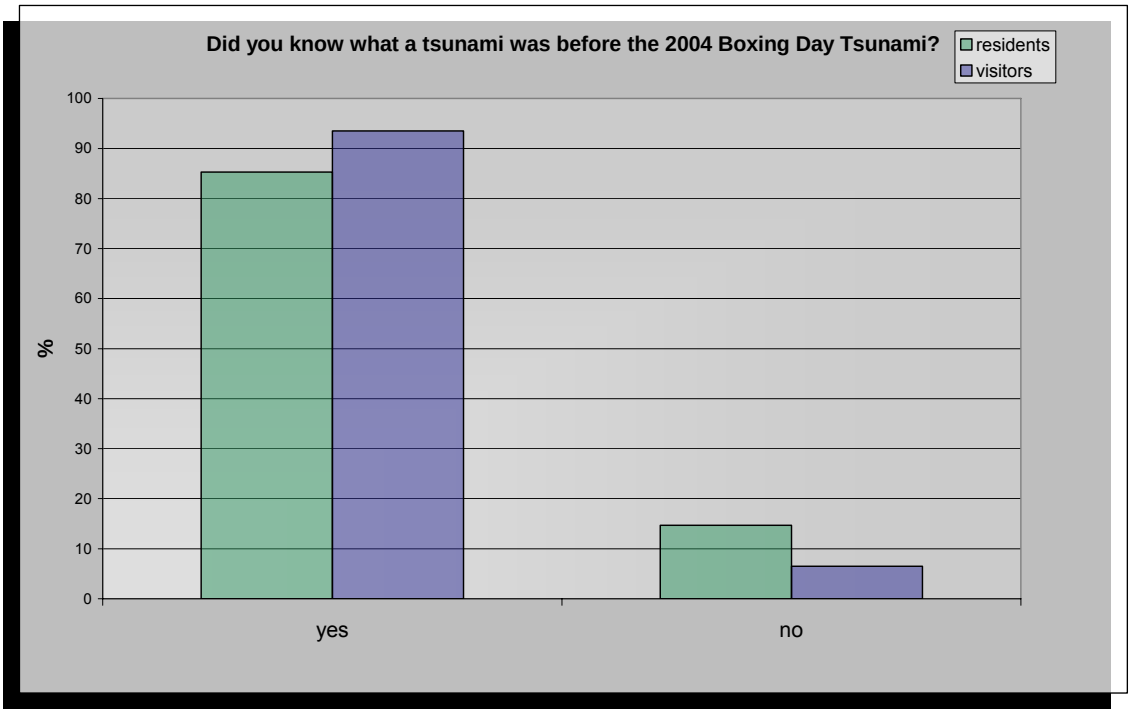
Though there is little in the literature regarding how individuals' perceptions of disasters change in the face of such catastrophes what has been noted consistently is how legislation and scientific endeavours are affected. "More of the major commitments of public policy in the field of resource management have arisen out of crises generated by catastrophic natural hazards" (Burton and Kates, 1964).

After large earthquakes laws have been instituted requiring buildings and infrastructure to meet certain engineering standards. After the 1933 Long Beach earthquake, the Field Act was introduced requiring schools to be up to seismic standards (May *et al,* 1999). Following the 1971 San Fernando earthquake it became a requirement for local governments to incorporate earthquake safety issues into their community plans, limitations were placed on construction inside of fault, and it became a requirement to inform prospective homeowners of fault lines on the property (May *et al,* 1999).

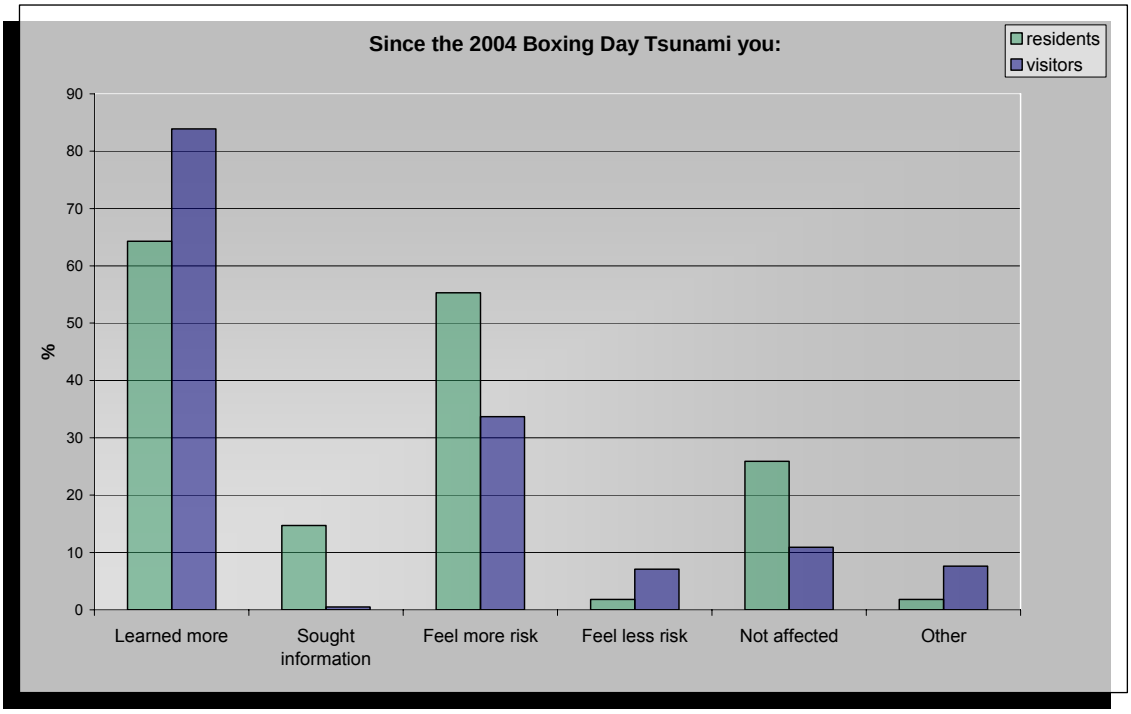
Similarly, for tsunamis a great deal of change has been initiated after major events. The Pacific Tsunami Warning Center (PTWC), located in Ewa Beach, Hawaii, was set up in 1949 in response to the 1 April 1946 tsunami, which was generated in the Aleutian Islands and killed approximately 165 people around the Pacific basin (Dudley and Lee, 1998). After the 23 May 1960 tsunami the PTWC was expanded to include the international community (Dudley and Lee, 1998). After the need for better warning from local source tsunamis was highlighted by the 1964 Alaskan tsunami the West Coast/ Alaska Tsunami Warning Center was set up for the states of Alaska, Washington, Oregon and California (Dudley and Lee, 1998). As a result of the Boxing Day tsunami a system is being established for the Indian Ocean with some advocating a global system for monitoring all oceans (Alverson, 2005).

6.4 Survey results

6.4.1 Since Boxing Day



In both the non-resident and resident survey participants were directly asked how the Boxing Day Tsunami had affected them and if they knew what a tsunami was prior to the event. Most respondents, over 80% of residents and over 90% of visitors, replied that they knew what a tsunami was prior to the event, however, "people may have forgotten they had not heard of tsunami prior to this event because of the media coverage following the disaster may have entered their subconscious resulting in a perception of previous knowledge" (Bird and Dominey-Howes, 2005).



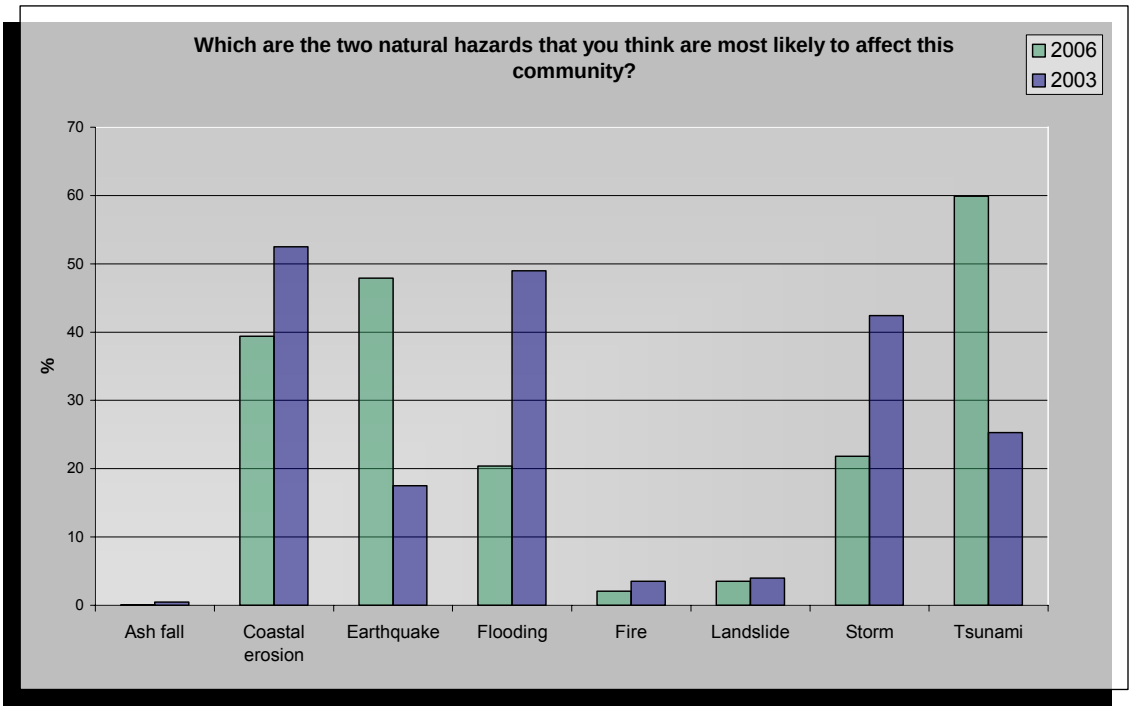
The most significant way in which individuals indicated that they were affected by the Boxing Day Tsunami was that they had learned more about tsunamis, with a higher percentage of visitors noting this. However, a relatively low percent of people have actively sought information.

Over a third of residents and over half of visitors replied that they felt more at risk since the event. Some people, however, replied that they felt less at risk, with a few citing that such a large event would be unlikely to occur again in the near future.

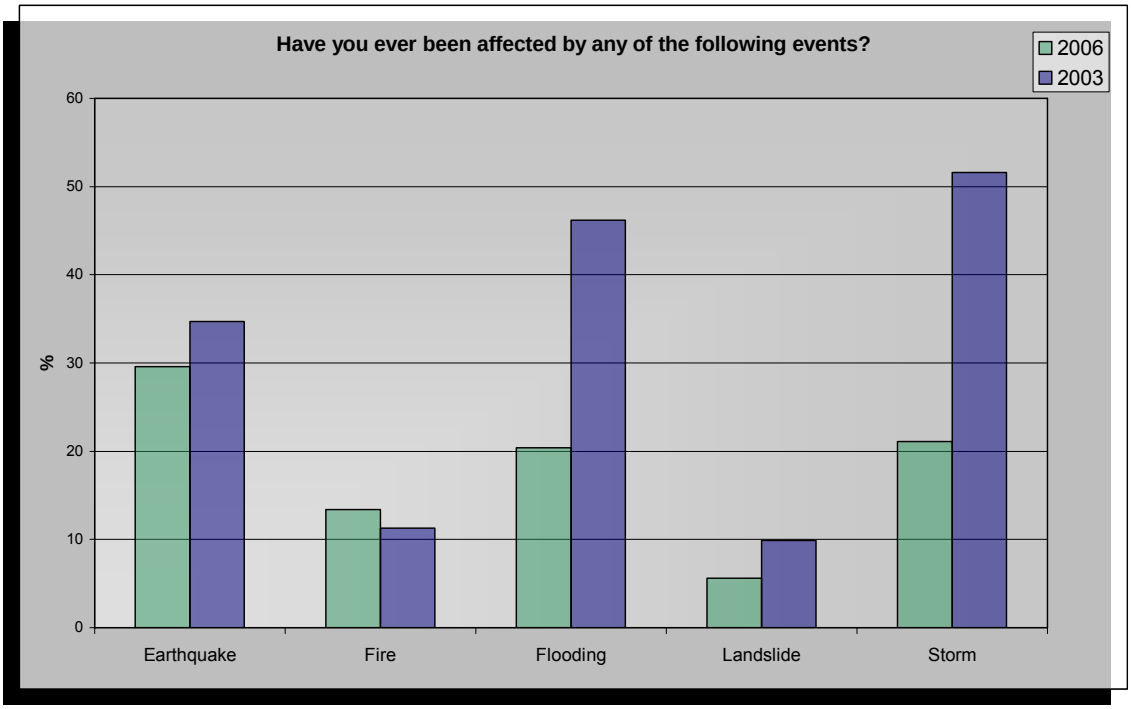
A small proportion of participants, less than a quarter of residents and just over 10 % of visitors, replied that they were not affected.

6.4.2 Comparing the 2003 and 2006 surveys

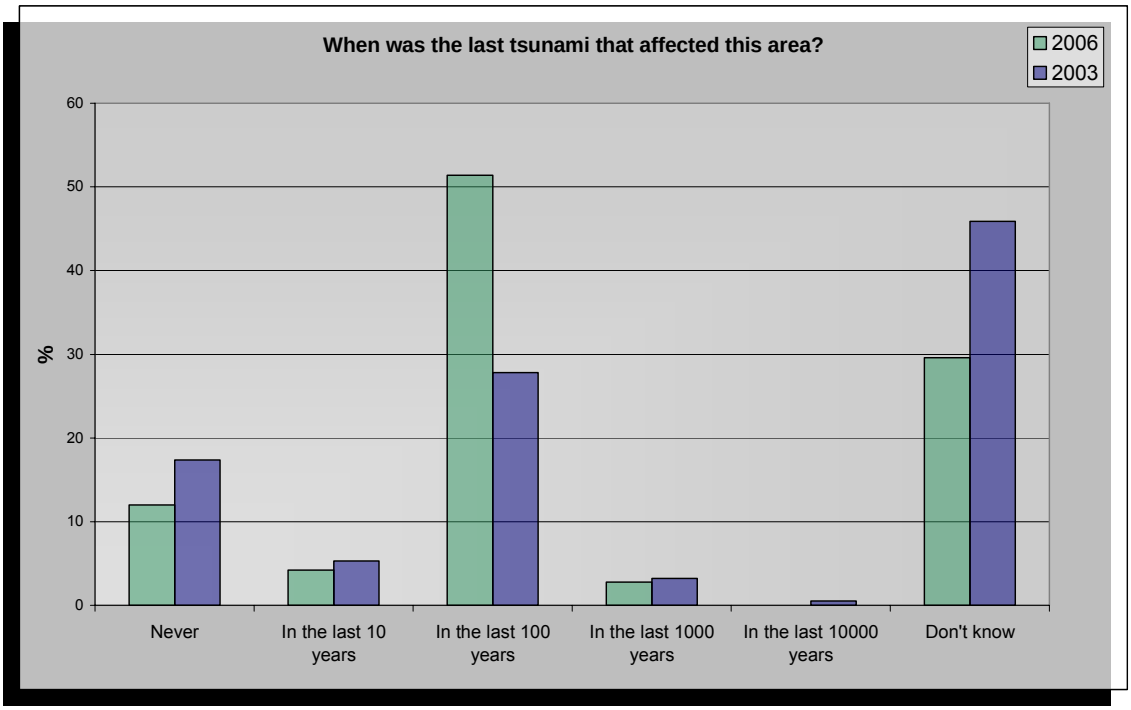
Questions asked directly to participants about how they have been affected since the Boxing Day event are subjective in nature, relying on the participant's feelings and memory. A more objective view can be obtained by comparing the surveys carried out before and after the tsunami and seeing if knowledge of tsunamis and warning systems has actually changed. For these comparisons the surveys from Pareora have been excluded because this location was not part of the original 2003 survey.



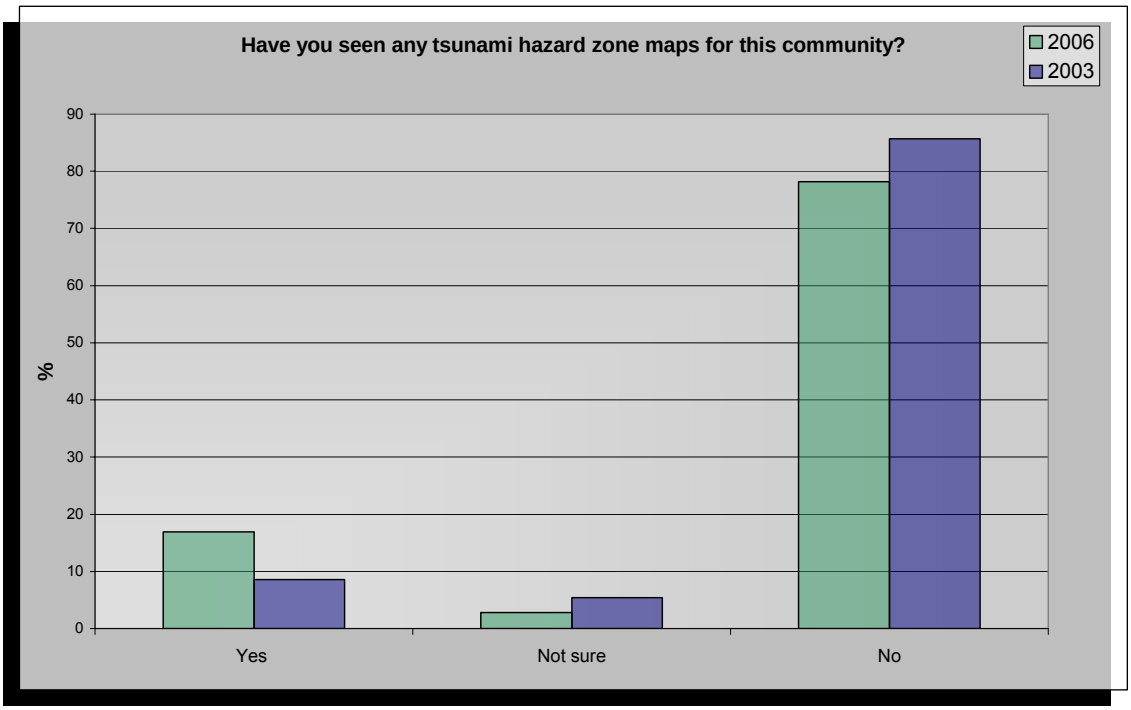
There was a significant increase in the amount of people who believed tsunamis would affect their community. Only approximately a quarter of those surveyed in 2003 believed tsunamis were a considerable hazard, whereas almost 60 % of those surveyed in 2006 rated tsunamis as one of the two most likely natural hazards, which is an increase of over 50%. Earthquake hazards were also thought to be more likely than previously. There was, though, a drop in the percent of people that though that coastal erosion, flooding and storms were problematic. Few people believed landslide, fire or ash fall to be probable in either survey year.



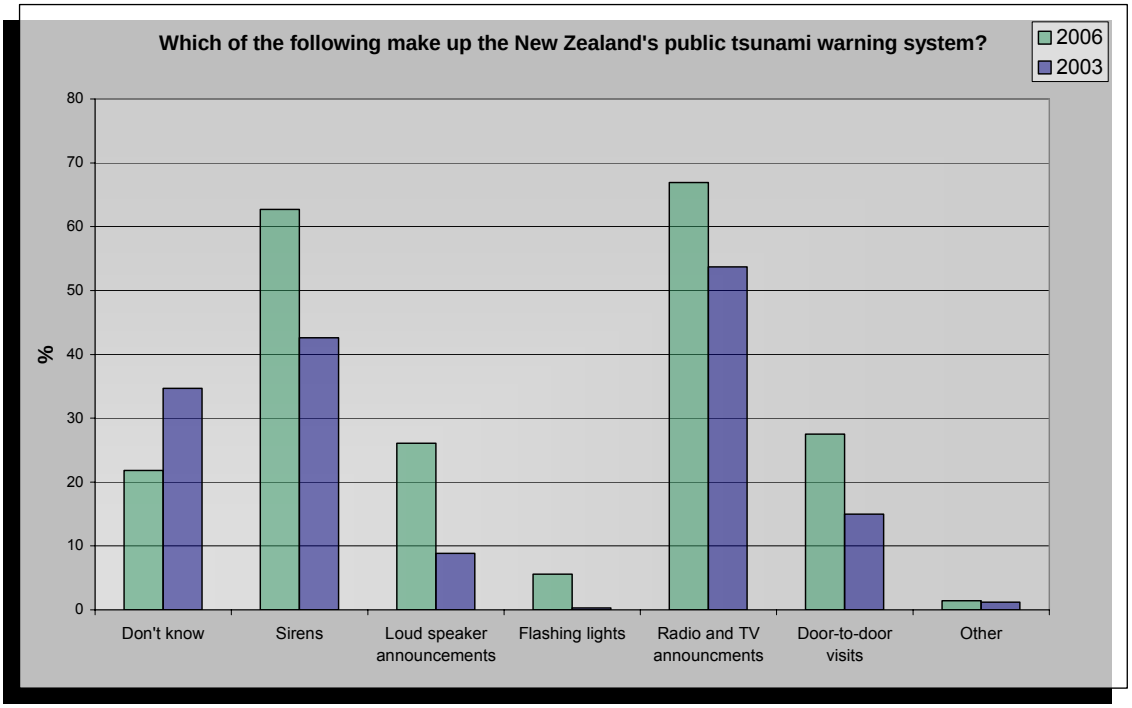
Almost half as many people were affected by flood in 2006 than in 2003, which would account for the corresponding decrease in individuals who believed flooding to be a likely hazard. There was also a comparable decline in storm experience and perception of storms as a viable hazard. There was only a small decline in those that had experience earthquakes since 2003.



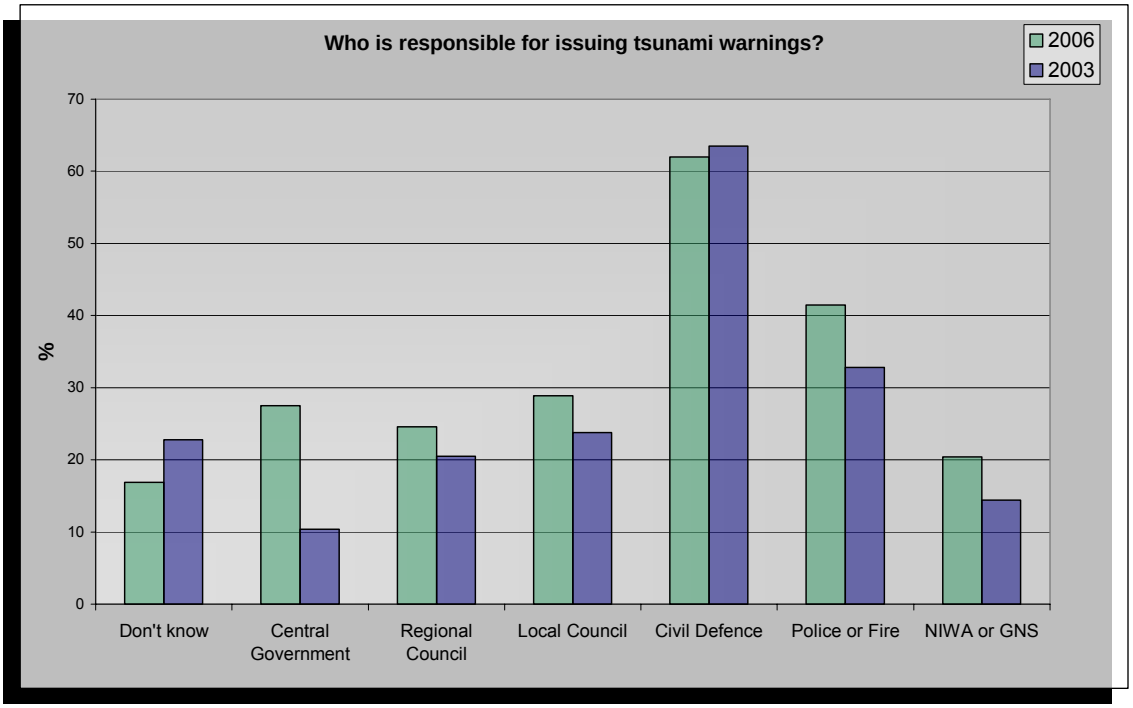
There was an increase in the percent of respondents who were aware of when the last tsunami occurred and an approximately equivalent decrease in the amount of participants who indicated "don't know." There was also a decrease in those that believed that a tsunami had never occurred.



There was only a slight increase in the amount of respondents who indicated that they have seen tsunami hazard zone maps, the majority, though, still have not.



There was a decrease in the "don't know" response since the 2003 survey. A greater number of people were aware that radio and TV announcements are part of the tsunami warning system; however, more people believed that sirens are also part of the system, which they are not.



There was little change in who people thought was responsible for issuing warnings. There was a decrease in the "don't know" category and a slight increase in all others. The greatest increase was that more people believed that central government was responsible for tsunami warnings.

Strongly disagree = 1 Strongly agree = 5	2003		2006	
	avg.	σ	avg.	σ
Tsunamis are too destructive to bother preparing for				
Kaikoura	3.8	1.3	1.8	1.1
New Brighton	3.6	1.5	2.5	1.6
Southshore	3.7	1.3	1.6	0.9
Sumner	3.9	1.3	1.5	1.0
It is unnecessary to prepare for tsunami as assistance will be provided by local/regional councils or Civil Defence				
Kaikoura	3.8	1.2	1.5	0.7
New Brighton	3.8	1.3	1.9	1.1
Southshore	4.1	1.0	1.4	0.6
Sumner	4.1	1.1	1.7	1.1

Participants in the 2003 survey were more inclined to agree with the statement that tsunamis are too destructive to bother preparing for whereas those from 2006 tended to disagree.

Respondents from 2003 were more likely to agree that they would not need to prepare for tsunamis since assistance would be provided. There was again a tendency to disagree from people surveyed in 2006.

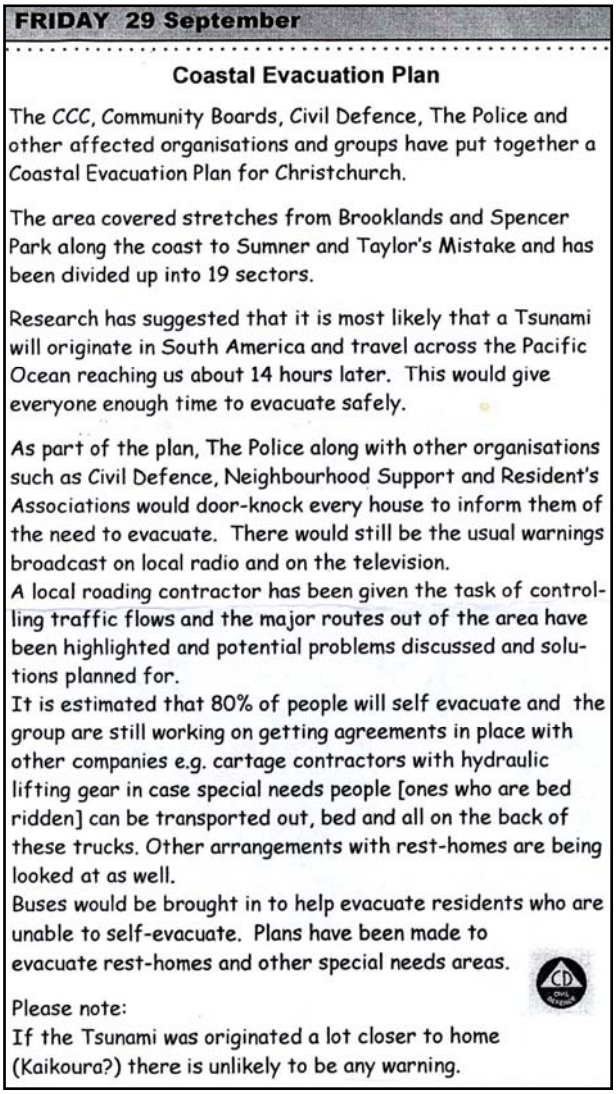
This shows a general trend towards the view that preparing is both possible and necessary.

In the next month or so, do you intend to:	**2003**			**2006**		
	No	**Possibly**	**Definitely**	**No**	**Possibly**	**Definitely**
Become involved with a local group/neighbourhood to discuss how to respond to tsunamis	78.7	20.6	0.5	71.0	25.4	3.6
Seek information on tsunami risks	54.3	41.0	4.7	28.5	54.7	16.1

There was little change in the amount of people intending to become involved in community or neighbourhood groups to discuss how to respond to tsunamis. There was still an overall negative response, though slightly more people indicated that they might "possibly" or "definitely" would become involved.

There was a more significant increase in those that indicated they would seek more information on tsunamis risks with about 10% more saying they would "possibly" and would "definitely" do so.

Have you heard or received information about preparing for tsunami hazards from any of the following? (Tick all that apply)			
	2003	***2006***	***change***
I haven't heard or received any information	63.5	42.3	-21.2
Friends	6.3	12.7	+6.4
Neighbours	1.8	4.2	+2.4
Relatives	3.4	7.7	+4.3
Central Government	2.4	8.5	+6.1
Region Council	5.2	15.5	+10.3
Local Council	8.3	19.7	+11.4
Local Civil Defence group	13.3	26.1	+12.8
Business establishments	0.0	0.7	+0.7
Research Organization	5.7	12.7	+7.0
My workplace	4.9	5.6	+0.7
My child's school	1.9	3.5	+1.6
Other	11.6	15.5	+3.9



FRIDAY 29 September

Coastal Evacuation Plan

The CCC, Community Boards, Civil Defence, The Police and other affected organisations and groups have put together a Coastal Evacuation Plan for Christchurch.

The area covered stretches from Brooklands and Spencer Park along the coast to Sumner and Taylor's Mistake and has been divided up into 19 sectors.

Research has suggested that it is most likely that a Tsunami will originate in South America and travel across the Pacific Ocean reaching us about 14 hours later. This would give everyone enough time to evacuate safely.

As part of the plan, The Police along with other organisations such as Civil Defence, Neighbourhood Support and Resident's Associations would door-knock every house to inform them of the need to evacuate. There would still be the usual warnings broadcast on local radio and on the television.
A local roading contractor has been given the task of controlling traffic flows and the major routes out of the area have been highlighted and potential problems discussed and solutions planned for.
It is estimated that 80% of people will self evacuate and the group are still working on getting agreements in place with other companies e.g. cartage contractors with hydraulic lifting gear in case special needs people [ones who are bed ridden] can be transported out, bed and all on the back of these trucks. Other arrangements with rest-homes are being looked at as well.
Buses would be brought in to help evacuate residents who are unable to self-evacuate. Plans have been made to evacuate rest-homes and other special needs areas.

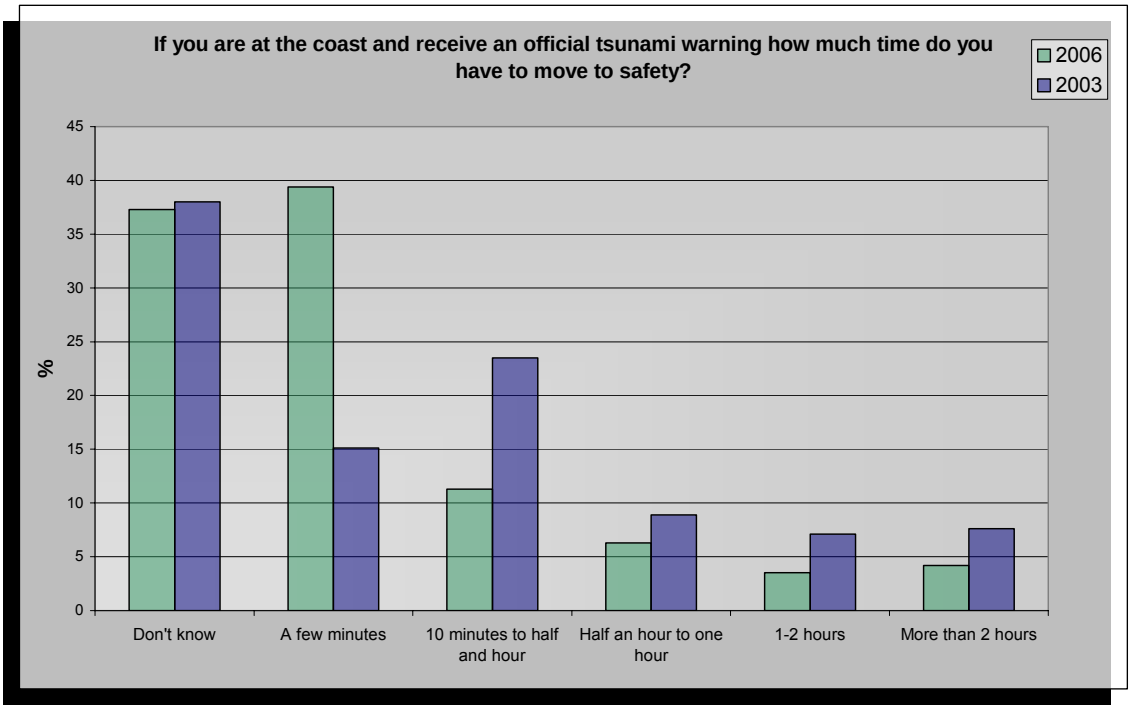
Please note:
If the Tsunami was originated a lot closer to home (Kaikoura?) there is unlikely to be any warning.

Figure 6.7: An article from the Southshore Beacon on tsunami evacuation (Southshore Beacon, 2006).

There was a significant decrease in the amount of people who had not heard or received any information and a slight increase in information received from most sources with the greatest increase being from Local and Regional Councils and Civil Defence. Some of this information has been council newsletters (figure 6.7) and civil defence brochures. Figure 6.7 is an article from the Southshore Beacon from 29 September 2006 which describes the plan for evacuation of the coastal area including the most likely location of origin, possible travel time, and how information would be received. This article was returned with one of the 2006 surveys and although it is questionable how much individuals learn from such information sources there is at least some short-term impact.

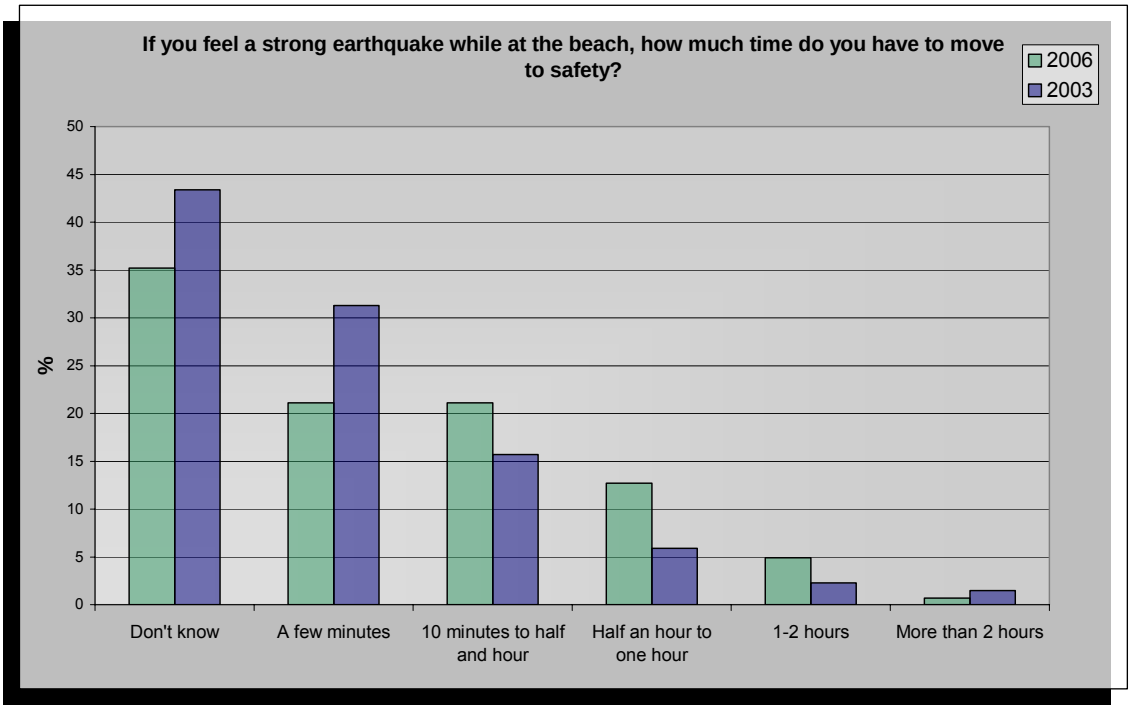
Have you asked any of the following people, groups or organisations for information on how to get ready for tsunami hazards? (Tick all that apply)			
	2003	***2006***	***change***
I haven't heard or received any information	86.9	85.9	-1.0
Friends	5.6	5.6	0.0
Neighbours	2.9	2.8	-0.1
Relatives	1.9	5.6	+3.7
Central Government	0.0	0.7	+0.7
Region Council	1.2	1.4	+0.2
Local Council	2.8	0.7	-2.1
Local Civil Defence group	1.6	4.9	+3.3
Business establishments	0.0	0.7	+0.7
Research Organization	0.0	1.4	+1.4
My workplace	1.7	2.3	+0.6
My child's school	0.7	1.4	+0.7
Other	0.9	0.0	-0.9

There was very little change in sources used for individuals engaging in active information seeking. In both the 2003 and 2006 surveys over 85% of participants indicated that they had not heard or received any information.



In both the 2003 and 2006 survey participants greatly underestimated the amount of time that they would have for distantly generated tsunamis, this was especially true for the 2006 survey where 25% more people thought that they would

have just a few minutes. The reason that individuals in the 2006 survey believed they would have even less time may have been because there was no warning for the tsunami that occurred on Boxing Day, although that was a locally generated tsunami residents may not have been aware of that fact.



Since the 2003 survey, there was minimal change in awareness of how much time to move to safety during a locally generated tsunamis. Although most people responded that they "don't know," respondents were generally aware that little time was available for individuals to move to safety.

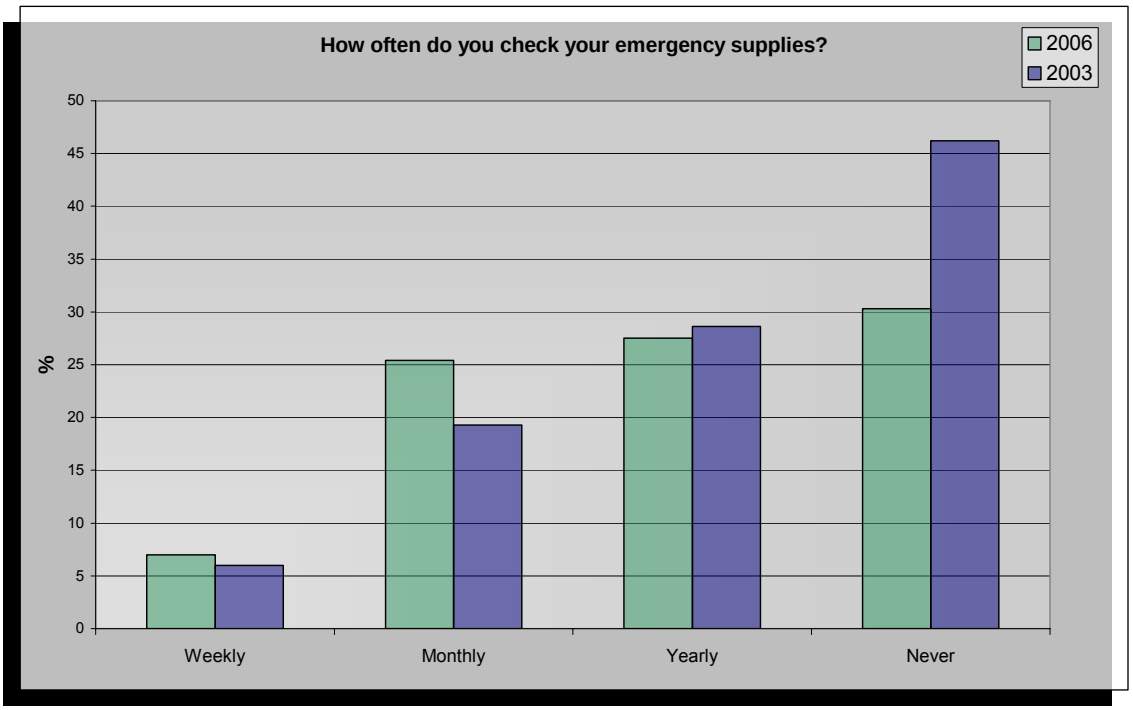
Strongly disagree = 1 Strongly agree = 5	2003		2006	
	avg.	σ	avg.	σ
I think that tsunami could pose a threat to my personal safety				
Kaikoura	3.1	1.2	3.8	1.5
New Brighton	2.7	1.3	4.2	1.1
Southshore	3.1	1.3	4.1	1.1
Sumner	2.8	1.2	4.4	0.7
I think tsunami could pose a threat to my daily activities				
Kaikoura	3.1	1.3	4.0	1.2
New Brighton	2.6	1.5	4.2	1.3
Southshore	3.1	1.3	4.1	1.2
Sumner	2.9	1.4	4.1	1.1

There was a tendency to agree more strongly in 2006 than in 2003 to the statements that tsunamis could pose a threat to both the individuals' personal safety and daily activities, though the results are within the error margin so it is difficult to ascertain for certain.

Has your household done any of the following to prepare for a hazard or emergency? (Tick all that apply).			
total n= 169	***2003***	***2006***	***change***
Have a working flashlight	82.4	80.2	-2.2
Protected breakable household items	12.1	12.7	+0.6
Put strong latches on cabinet drawers	11.3	7.7	-3.6
Stored hazardous materials safely	42.0	42.3	+0.3
Added edges to shelves to keep things from sliding off	3.1	2.1	-1.0
Strapped water heater	23.1	24.6	+1.5
Installed flexible tubing to gas appliances	5.7	4.2	-1.5
Bolted house to foundation	15.0	19.0	+4.0
Stockpiled water and food for three days	28.3	54.2	+25.9
Have working portable radio and spare batteries	49.0	57.0	+8.0
Have a working fire extinguisher	41.0	42.3	+1.3
Have a working smoke detector	74.8	84.5	+9.7
Have a first aid kit	70.4	81.0	+10.6
Stored wrench near gas turn-off valve	2.3	2.8	+0.5
Picked an emergency contact person outside your local area	16.1	18.3	+2.2
Someone in family has learned how to put out fires	40.2	42.3	+2.1
Bought additional insurance (e.g. home)	41.7	34.5	-7.2
Someone in family has learned to provide first aid	52.8	56.3	+3.5
Found out if you are in an area particularly vulnerable to a disaster (such as an earthquake, flood or tsunami)	24.6	54.9	+30.3
Have had home inspected for preparedness	0.5	2.8	+2.3
If a you are a visitor have you checked for emergency supplies where you are staying	0.7	1.4	+0.7
Talked to family members about what to do if a tsunami hazard warning is heard	14.1	33.1	+19.0

There were generally slight changes in preparatory measures taken by respondents although there were some very notable increases. There was an almost 30% increase in those who had stockpiled three days worth of food and water. There was also an increase of over 30% in those that had found out if they were in an area particularly vulnerable to disasters. Almost 20% more people had talked with their families about what to do in the event of a tsunami warning. More participants had first aid kits, working smoke detectors, and a portable radio and batteries. Some of these increases in preparatory activities could result from influences other than the

2004 Boxing Day tsunami including the blizzard that affected most of southern Canterbury during the winter of 2006 and the advertisements for the Civil Defence webpage www.getthru.govt.nz, which has emphasized the stockpiling of food. The largest decrease was in those who had bought additional insurance.



There was a substantial increase in the amount of people that checked their emergency supplies on a monthly basis and decrease in those that never had, with approximately 15% less people having never checked supplies. Neither weekly nor yearly checks changed significantly, though there was a 7% increase in monthly supply checks.

6.5 Discussion

In an interview after the event it was quoted that "Before December 25, very few people knew what a tsunami was. After December 26, almost everyone does" (Lautenbacher Jr., 2005). Although most people reported already knowing what a tsunamis was most people also indicated that they learned more.

In terms of general tsunami knowledge there was a significant increase in those who knew when the last tsunami had occurred, though there was minimal

change in information receipt or seeking. In addition, most individuals still do not plan to engage in future information seeking or group discussions.

There was an increase in those who knew the proper authorities to expect a warning from, though there was also an erroneous increase in those who expected to hear a siren warning. Another noteworthy change was that more people believed that they would have less time to move to safety after an official warning. This may have been because there was no warning for the tsunami that occurred on Boxing Day, and although that was a locally generated tsunami residents may not have been aware of that fact. And even though there was an increase in those who perceived tsunamis as a possible risk and more people believed that preparing was possible, there were generally minor increases in preparatory measures.

Though, it may not be quite true that "that December day forever changed the world's appreciation for how much damage tsunamis can inflict" (Geist *et al,* 2006), this event certainly made an impact, increasing people's knowledge and awareness, but not necessarily forever. Only years after the 1946 tsunami, funding for the warning centre virtually dried up and when the 1960 tsunami occurred 61 people were killed, many of whom had returned to the hazards zone between waves (Dudley and Lee, 1998) or did not evacuate at all because of misunderstanding of the warning system (Gregg *et al,* 2007). In the case of the 2004 Boxing Day tsunami the death toll and destruction were far greater, so it may be remembered for longer, but eventually the lessons learned will fade.

Chapter 7

Mitigating the tsunami hazard in Canterbury

7.1 The tsunami threat to Canterbury

The potential tsunami hazard in Canterbury is clearly recognized (Canterbury Regional Council, 1992; Owens *et al,* 1994) and tsunamis are classified as a high priority for Christchurch in the Canterbury Civil Defence emergency management plan (Canterbury Civil Defence Emergency Management Group, 2004). Historically Christchurch has been affected by four tsunamis and Banks Peninsula has been affected by eight (deLange and Healy, 1986). The physical and economical impacts, however, have been minimal, with bores travelling up the Avon and Waimakariri Rivers, recorded changes in tide levels, flooding, and damage to bridges, the most extensive of which occurred during the 1868 (figure 7.1) and 1960 tsunamis (deLange and Healy). The greatest wave heights of 4-4.35 meters in the Canterbury

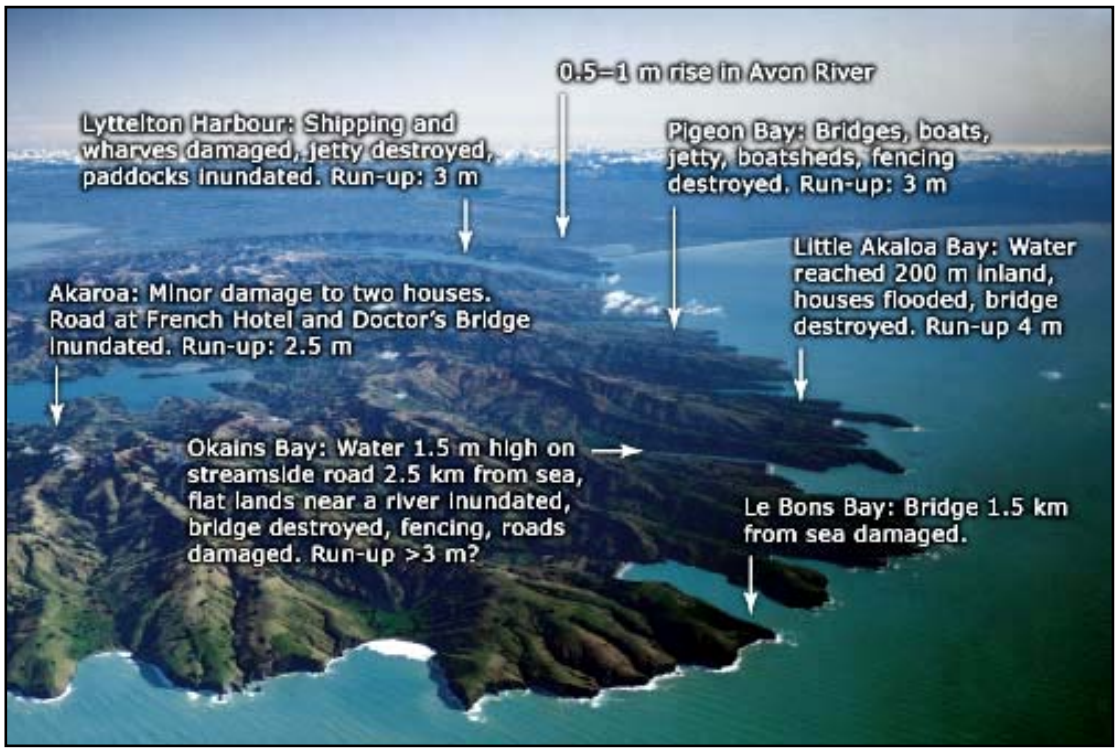


Figure 7.1: Damage caused by the 1868 tsunami (Te Ara, 2005).

Region were recorded during the 1960 tsunami at Lyttelton Harbour (Intergovernmental Oceanic Commission, 2006).

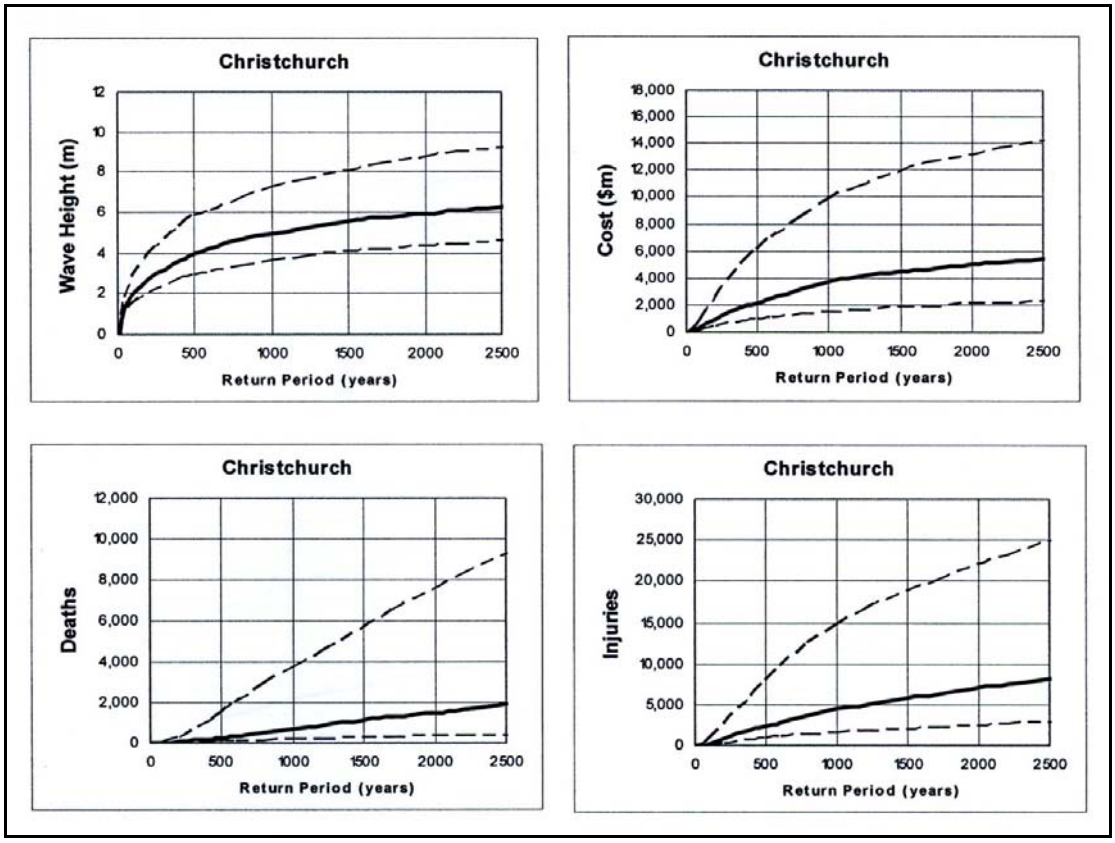


Figure 7.2: Estimated wave heights, cost, deaths, and injuries for a tsunami in Christchurch (Berryman, 2005).

Tsunami damage is expected in the future, though; devastation, economic effects, wave heights and casualties (figure 7.2) will not be to the same catastrophic degree as the Boxing Day tsunami. In a 500 year return period wave heights are estimated at four meters with deaths in the hundreds (Berryman, 2005). The scope of the report, though, was limited due to time restrictions and did not address the issue of non-resident summer populations and tourism concerns (Berryman, 2005).

Coastal areas, such as Banks Peninsula and coastal Christchurch, undergo significant changes in population during the summer months due to the influx of tourist. It is important for hazard management purposes to know what the population changes are including both the maximum number of people and what the average occupancy is for evacuation and planning purposes. In New Zealand Statistics New Zealand and the Ministry of Tourism record visitor information such as occupancy rate. The following tables (7.1 and 7.2) are from the Ministry of Tourism's commercial Accommodation Monitor and they represent the figures for

accommodations in both the Christchurch City and the former Banks Peninsula districts (now incorporated into the Christchurch City district) (Ministry of Tourism, 2006).

Banks Peninsula										
	2005								2006	
Measure	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**
Establishments	34	31	27	29	32	38	39	39	39	39
Daily Capacity	1,130	1,075	1,054	1,074	1,120	1,182	1,186	1,163	1,165	1,168
Capacity Per Period	35,030	32,250	32,674	33,294	33,600	36,642	35,580	36,053	36,115	32,704
Stay Unit Nights	4,428	3,107	3,585	2,856	4,666	6,533	9,022	9,982	15,219	13,108
Guest Nights	6,993	5,348	6,152	5,044	7,906	11,648	15,215	22,621	39,611	24,737
Guest Arrivals	4,282	3,347	3,754	3,208	4,624	7,054	9,478	12,058	18,401	14,655
Length Of Stay	2	2	2	2	2	2	2	2	2	2
Occupancy Rate %	13	10	11	9	14	18	25	28	42	40

Table 7.1: Holiday park figures for the Banks Peninsula district (Ministry of Tourism, 2006).

Christchurch										
	2005								2006	
Measure	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**
Establishments	211	209	202	208	210	213	217	217	216	216
Daily Capacity	8,686	8,677	8,625	8,699	8,734	8,811	8,878	8,869	8,874	8,875
Capacity Per Period	269,266	260,310	267,375	269,669	262,020	273,141	266,340	274,939	275,094	248,500
Stay Unit Nights	122,115	131,580	125,257	116,780	127,948	151,870	168,192	153,921	173,805	182,915
Guest Nights	195,598	218,716	218,220	194,071	222,380	263,263	286,323	281,129	328,636	319,099
Guest Arrivals	109,717	109,047	115,644	104,376	125,608	146,700	160,574	157,425	172,084	179,343
Length Of Stay	2	2	2	2	2	2	2	2	2	2
Occupancy Rate %	45	51	47	43	49	56	63	56	63	74

Table 7.2: Table 2: Holiday park figures for the Banks Peninsula district (Ministry of Tourism, 2006).

Location	**Maximum occupancy**
Duvauchelles	460
Kairaki Beach	300
Little Akaloa	125
Okains Bay	600
Pigeon Bay	125
Purau Bay	750
South Brighton	400
Spencer Beach	1400
Wood end	500
Total	**4660**

Table 7.3: Peak capacity for coastal holiday parks.

As can be seen from the tables there is a definite seasonal variance in visitors by month with January and February being the peak months. Not all of the accommodations represented in the dataset are coastal establishments nor are they holiday parks. The occupancy rate for coastal accommodations, though, can be approximated from the average occupancy rate for each month and from the peak occupancy, which was provided by managers at each of the survey locations (table 7.3). The percentages given are only for holiday parks and are calculated from Statistics New Zealand data from 1997 to 2005 (Statistics New

Zealand, 2006). Between the period of Christmas Eve and New Years Day, though, holiday parks are usually at or near capacity. This adds greatly to the possible deaths estimated by Berryman *et al* (2005).

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
avg. %	29.3	21.2	8.1	14.9	18.0	6.9	7.1	6.8	9.3	12.2	14.0	21.3
exp. #	1365	990	377	694	837	321	333	317	435	570	651	993

Table 7.4: Estimated population increase from holiday park visitors.

There are extensive effects, in addition to fatalities, expected for the region. In Christchurch, widespread damage of up to 30% of the urban area could occur with flooding from dune overtopping (figure 7.3) and high water levels up the Avon River and in the Avon-Heathcote estuary (Owens, 1994). Coastal road access could be disrupted, damage to port harbour facilities at Lyttelton and Timaru, structural damage to industrial sites and the Pareora freezing works, extensive dune overtopping, and significant flooding of locations under 5 meters are probable (Owens, 1994).

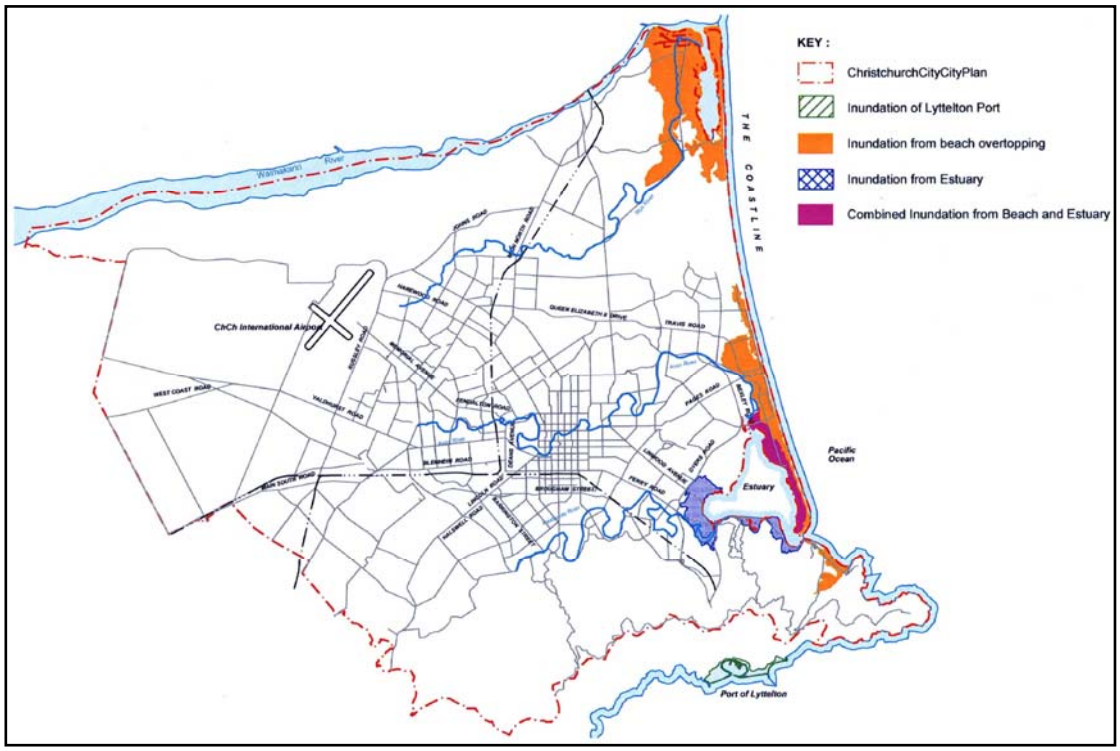


Figure 7.3: Tsunami hazards map for Christchurch (Christchurch Engineering Lifelines Group, 1997).

7.2 Preparedness in Canterbury

7.2.1 The Perception-preparation model

A threat from tsunamis certainly exists. The general population is aware of the hazard and commonly perceives it as a risk; however, perceiving risk from a hazard is only the first step in becoming prepared. Individuals need to then develop intentions to adopt preparatory measures and convert those actions into actual behaviour (Johnston *et al*, 2002). Although tsunamis are perceived as a possible risk, preparatory measures are quite low. To understand these low rates an examination of residential views in regards to the perception-preparation model (figure 7.4) follows.

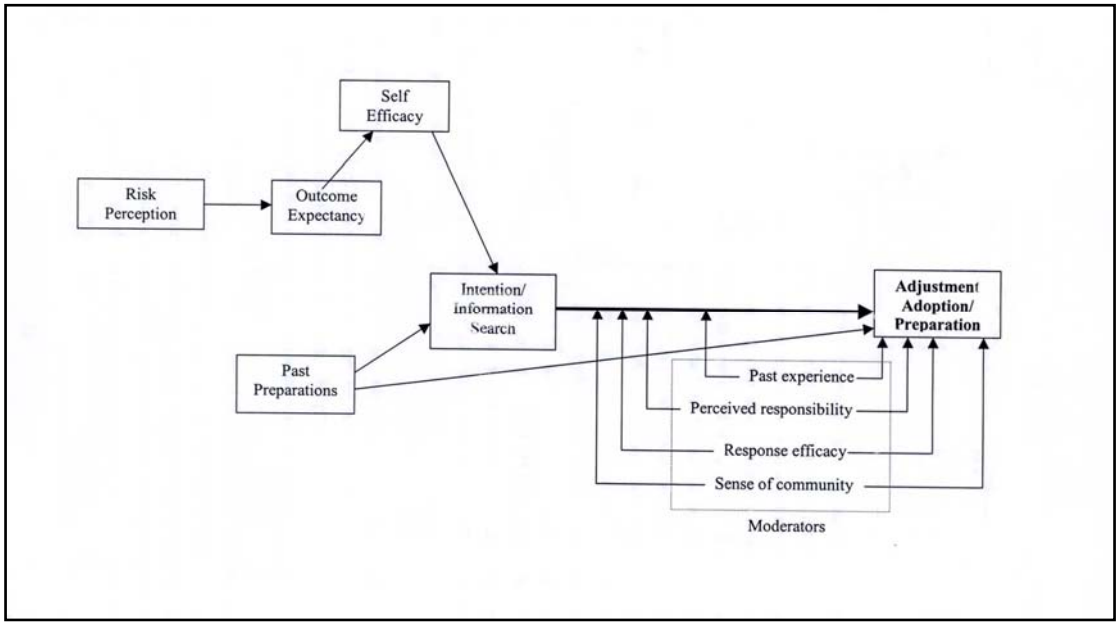


Figure 7.7: The perception-preparation model (Johnston *et al,* 2002).

7.2.2 Risk perception

	N	Mean	Std. Deviation
I think tsunamis could pose a threat to my personal safety	164	4.08	1.193
I think tsunamis could pose a threat to my daily activities (such as work, leisure or property)	161	4.03	1.232
Tsunamis won't affect this area	166	1.81	1.224
Tsunamis won't affect me	166	1.84	1.226

Response to these questions indicates high level of perceived threat from tsunamis with individuals believing tsunamis could affect their safety, daily activities and their locations.

7.2.2 Outcome expectancy

	N	Mean	Std. Deviation
Tsunamis are too destructive to bother preparing for	161	1.96	1.308

Outcome expectancy describes the degree to which an individual believes their preparatory actions will be effective (Johnston *et al*, 2002) and is relatively high for Canterbury residents. The majority of respondents viewed preparation as effective and possible in saving lives and as a means to improve their ability to deal with disruption to their family and communities.

7.2.3 Self efficacy

"Self-efficacy is defined as people's beliefs about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives" (Bandura, 1994). Unfortunately, none of the survey questions dealt with self-efficacy.

7.2.4 Intention/information search

	N	No	Possibly	Definitely
Improve your knowledge of how to respond to tsunamis	167	27.5	61.1	11.3
Increase your ability to respond to tsunamis	165	27.5	60.0	12.1
Become involved with a local group/neighbourhood to discuss how to respond to tsunamis	166	71.7	25.3	3.0
Seek information on tsunami risks	164	41.5	41.5	17.1
Seek information on things to do to respond to tsunamis	165	29.3	53.0	17.7

There was generally low to moderate tendencies towards information seeking. This is consistent with the fact that few people had engaged in any information seeking at present.

7.2.5 Prior experience

1- little impact, 10- severe impact	n	Mean	Std. Dev
Chemical spill	9	4.2	3.23
Climate change	17	3.5	2.29
Earthquake	47	2.0	1.33
Fire	19	4.2	2.30
Flood	37	4.0	2.74
Infrastructure failure	63	3.6	2.28
Landslide	8	3.5	1.60
Pandemic	1	1.0	0.00
Storm	42	3.8	2.18
Tornado	3	3.3	4.04
Volcanic eruption	3	2.0	1.00

There was a wide range of prior hazard experience, most of which had negligible impact. Individuals who have experienced minor effects that are considerably smaller than what can potentially occur from a hazard will feel that they

have had experience with the hazard. This can result in a normalisation bias (Johnston *et al,* 1999; Johnston *et al*, 2002; Leonard *et al,* 2004) where residents who that they have been thru a hazard will presume that they can take the same minimal measures they took previously (Drabek, 1986).

7.2.6 Perceived responsibility

	N	Mean	Std. Deviation
It is unnecessary to prepare for tsunamis as assistance will be provided for me by Civil Defence	163	1.64	.992

Participants were likely to disagree with the statement that "It is unnecessary to prepare for tsunamis as assistance will be provided for me by Civil Defence," indicating their belief in their need for self-sufficiency. This indicates a generally high sense of responsibility amongst Canterbury residents.

7.2.7 Sense of community

	N	Mean	Std. Deviation
I feel 'at home' in this community	164	4.46	.746
I am satisfied living in this community	163	4.45	.738
I am a useful member of this community	161	3.57	1.139
I have the same values and beliefs as my neighbours	153	3.48	1.119
I feel I don't belong in this community	159	1.48	.856
Am interested in knowing what goes on	164	3.87	1.130
I would be happy to leave this community	158	2.08	1.231
I know my neighbours and/or other community members	164	3.70	1.260
I have no active involvement in this community	160	2.63	1.395

A high sense of community commonly supports adoption of preparatory measures (Johnston *et al,* 2002). Individuals require time, though, to make contacts in the community, form social groups and then to develop their knowledge about local hazards and finally make preparatory adjustments to those hazards (Leonard *et al,* 2004). Over half of respondents, though, had lived in their home and community for over five years, which is sufficient time to have made such contacts, and altogether there is a strong sense of community.

7.2.8 Reasons for low preparedness

Overall, a low tendency towards preparatory activities was found, though many of the precursors towards preparedness were high. These low levels can be attributed to a normalization bias from previous low impact from hazards and a low perception of expected occurrence. Even though preparedness is low, the population may still take appropriate actions and evacuate during a tsunami event. The majority of individuals indicated that they knew to go inland and uphill. However, several factors affect people's decisions to evacuate.

7.3 Evacuation behaviour

In the past 175 years, since 1813, there have been 95 historical tsunamis (Dudley and Lee, 1998). With heavy media coverage since the 2004 Boxing Day event the devastation that tsunamis can cause should be well known and evacuation after receipt of a warning should be high, though individuals do not always respond appropriately to evacuation warnings.

General evacuation behaviour for natural disasters has been well studied in the last half century. According to Drabek (1986) when a population is adequately warned prior to a natural disaster, approximately 50% of that population will evacuate, although actual evacuations rates will vary between different events and from place to place during the same event (Baker, 1991) (table 7.5). The variation in evacuation rates is due to a number of factors including the amount of perceived risk, understanding of the warning, whether a warning was received, past experience with or knowledge of the hazard, and severity of the threat (Baker, 1991, Aguirre, 1991,

Riad *et al,* 1999). The highest evacuation rates occur when the individuals feel personally at risk and understand that the evacuations warnings apply to them (Baker, 1991). The extremely high evacuation rate of 97% was reached in Pensacola Beach during Hurricane Frederic with door-to-door communication of the evacuation orders.

Hazard	Location	% Evacuated	Reference
Tsunami			
1960	Hilo, HI	32%	Dudley and Lee, 1998
Hurricane			
Carla 1961	Galveston, TX	68%	Baker, 1991
Alicia 1983	Galveston, TX	47%	Baker, 1991
Eliose 1975	Panama City Beach, FL	87%	Baker, 1991
Frederic 1979	Panama City Beach, FL	54%	Baker, 1991
Frederic 1970	Pensacola Beach, FL	97%	Baker, 1991
Lili 2002	Cameron Parish, LA	86.8%	Lindell *et al,* 2005
Lili 2002	Orange County, TX	46.1%	Lindell *et al,* 2005
Lili 2002	Chambers County, TX	11.7%	Lindell *et al,* 2005
Gilbert 1988	Cancun, Mexico	25%	Aguirre, 1991
Volcano			
1980	Mt. St. Helens, WA	88.9%	Drabek, 1986
Flood			
2001	Grafton, New South Whales	18%	Pfister, 2002

Table 7.5: Percentages of populations that evacuated following receipt of official warning.

These same criteria apply to self-evacuations, but knowledge of the hazards and natural warning signs must be greater. In the 2003 National Coastal Community Survey residents were asked several questions pertaining to their knowledge of tsunamis. When asked if they were to feel a strong earthquake while at the beach how much time they would have to move to safety from an impending tsunami 42.7% responded that they did not know and 15.8% overestimated (Johnson *et al,* 2003). In the current survey the majority of residents indicated that they would move uphill or inland during a local tsunami. This differed from a distantly generated tsunami in the participants generally indicated that they would take more supplies. Individual's also tended underestimate the time they had available to move to safety during a distant tsunami.

Thousand of residents including nearly the entire populations of Whitianga, Waihi Beach, Wakatane, Ohope, and Opitiki, in the largest evacuation in New Zealand history, were evacuated three days after the 1960 Chilean tsunami, where it

was believed that an aftershock had caused a second tsunami (Johnston *et al,* submitted). Large numbers of people, though, travelled into the hazard zone to watch for the arrival of the tsunami (Johnston *et al,* submitted). Entry into the hazard area for sightseeing purposes has also been observed in Hawaii and California during the 1960 tsunami (Dudley and Lee, 1998).

Even though survey data suggest that residents are aware of the appropriate actions to take, they may not head warnings and may in fact act contrarily to them. Not all individuals, however, will return to the hazard zone for sightseeing purposed.

Another concern in regards to evacuation is that there is a significant proportion among campground visitors who are of local origin. Upon hearing a tsunami warning these visitors may attempt to return to residences within the hazard zone. Although there will be two way travel into and out of the coastal zone for at least for some time after the initial warning tourist would be returning potentially after hours. This could negatively affect evacuations. Holiday park locations need to incorporate a localized meeting location into their emergency plans to direct these travellers to in order to minimize this possible disruption.

Another reason that residents may re-enter the hazard zone is to retrieve school-aged children. The majority of residents with school-aged children who were surveyed were unaware of whether or not their children's schools a had preparedness plan that involved tsunamis. Most participants indicated that they would go and get their children from school in the event of a tsunami warning. Schools located in the coastal area will need to develop plans that include tsunamis and clearly communicate them to parents. Although these plans may only need to specify that for any emergency requiring evacuation students with be relocated to a specified location outside of the hazard zone. As long as parents are informed and trust that the school has a plan this may reduce travel into the coastal zone during an evacuation.

Chapter 8
Conclusions

8.1 Conclusions

People are familiar with earthquakes, floods, windstorms and droughts because they occur frequently. Individuals have more accurate risk perception for such familiar hazards and are therefore more likely to take preparatory measures before a natural disaster and self-protective actions during an event (Weinstein, 1989). However, many individuals see low-probability events, such as tsunamis, as synonymous with non-occurrence events (Rogers, 1997). Given the low probability of occurrence and a history of minimal damage, individuals are likely to have very low risk perception, little knowledge of the hazard and warning systems and are unlikely to be prepared. Individuals surveyed had high levels of awareness and risk perception, though preparatory measures were found to be low. Overall, a low tendency towards preparatory activities was found, even though many of the precursors towards preparedness were high. These low levels can be attributed to a normalization bias from previous low impact from hazards and a low perception of expected occurrence.

This is an even greater issue for tourists to an area who are likely to have even less knowledge and awareness of possible hazards and what to do in the event of a tsunami (Alexander, 2002). Visitors knew less about general tsunami information such as when the last tsunami occurred and were less likely to believe that a tsunami could occur imminently. Non-residents reported less receipt of information and did considerably less information seeking. Differences in knowledge of warning systems were difficult to ascertain because of the differences in question format and styles between the surveys. Residents were also more likely to indicate that they did not know how much time they would have to move to safety during a tsunami and both residents and visitors were equally aware of the proper actions to take in the event of a tsunami. However, over 90% of holiday park visitors surveyed were local rather than national or international visitors which skews the results towards greater knowledge and preparedness. For a better view of visitors' perceptions surveying hotels and

hostels would prove more accurate, since these accommodations are more likely to have international guests.

Tourists also bring a temporary increase the population to an area, further increasing the risk. There is a definite seasonal variance in visitors by month with January and February being the peak months. This population was not incorporated into the estimates of Berryman (2005) and changes the risk throughout the year. Non-residents increase the estimated fatalities by at least twice as much as the over a 500 year return period.

After a large-scale disaster such as the 2004 Boxing Day Tsunami, changes can occur in perceptions of tsunami hazards, how they are viewed and what is known about them. Though, it may not be quite true that "that December day forever changed the world's appreciation for how much damage tsunamis can inflict" (Geist *et al*, 2006), this event certainly made an impact, increasing people's knowledge and awareness, but not necessarily forever. In terms of general tsunami knowledge there was a significant increase in those who knew when the last tsunami had occurred, though there was minimal change in information receipt or seeking. In addition, most individuals still do not plan to engage in future information seeking or group discussions.

There was an increase in those who knew the proper authorities to expect a warning from, though there was also an erroneous increase in those who expected to hear a siren warning. Another noteworthy change was that more people believed that they would have less time to move to safety after an official warning. This may have been because there was no warning for the tsunami that occurred on Boxing Day, and although that was a locally generated tsunami residents may not have been aware of the fact. And even though there was an increase in those who perceived tsunamis as a possible risk and more people believed that preparing was possible, there were generally minor increases in preparatory measures. Changes in risk perception are expected to be short-lived, however, so it is important for hazard managers to institute policies and improve public education immediately after catastrophic events.

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Appendices

Appendix 1

New Zealand Tsunamis

Date		Source Location	Source Mechanism	Regions Affected	Run-up (m)	Source
1843	8-Jul	Wanganui, NZ	7.5-7.75 EQ	**Manawatu-Wanganui**		TL, DH
				Wanganui	0.5	
1845	5-Jul	Wanganui, NZ	EQ	**Manawatu-Wanganui**		TL, DH, N
				Wanganui	1	
1848	15-Oct	Lower Wairau Valley, NZ	7.1 EQ	**Wellington**		TL, DH, AF, T, N, R
				Wellington	0.36	
1848	17-Oct	NZ	7-7.1 EQ	**Wellington**		TL, N
				Wellington		
1855	23-Jan	W. Wairarapa	8.0 EQ	**Wellington**		TL, DH, AF, T, N, R
				Wellington	3-3.1	
				Paliser Bay	9-9.1	
				Marlborough		
				Wairau River	6	
				Nelson		
				Nelson	2	
				Canterbury		
				Avon River	.3-1.25	
1856	2-Mar	Canterbury, NZ, Chatham Rise	Unknown	**Canterbury**		TL, DH, AF, T, N
				Waiho River	3	
1868	13-Aug	Arica, N. Chile	9.1 EQ	**Northland**		TL, DH, AF, T, N, R
				Mangonui	1.2-1.5	
				Russell	1.5	
				Auckland		
				Tamaki Estuary	1.2-1.5	
				Orewa	1.8	
				Rosalie Bay	2	
				Tryphena Harbour	1.5	
				Great Barrier Island	2-2.9	
				Bay of Plenty		
				Opotiki	1.8-2	
				Cape Runaway	3	
				Waikato		
				Port Charles	1.8	
				Hawkes Bay		
				Napier	1.8	
				Wellington		
				Wellington	1.5	
				Castlepoint	0.6	
				Nelson		
				Nelson	1.2-1.5	
				Canterbury		
				Timaru	1.8-3.1	
				Pigeon Bay	1.2-3.05	
				Okains Bay	3-3.95	
				Kaiapoi	1.2-1.5	
				Waimakariri River	1.2	
				Little Akaloa Bay	4-4.6	

					Lyttleton	4-5.5
					Christchurch	0.5
					Akaroa	2.5
					Avon River	0.5-1
					LeBons Bay	
				Otago		
					Oamaru	1.5
					Taieri River	3
					Port Chalmers	3.25
					Dunedin Bay	1
					Otago Bay	0.3
					Heads	1.5
				Southland		
					Riverton	0.9
					Invercargill	1.5
					Campbelltown	0.9
					Bluff	1.5
				West Coast		
					Westport	1.2-1.5
				Chatham Islands		
					Chatham Islands	10
1868	18-Oct	Cape Farewell, NZ				T
1877	10-May	Inique, N. Chile	8.8 EQ	**Northland**		TL, DH, AF, T, N, R
					Russell	1.8
					Paihia	2.4
					Warkworth	1.8
					Bay of Islands	2.5-3
					Wairoa Bay	2
				Auckland		
					Auckland	0.2
				Bay of Plenty		
					Tauranga	1-1.8
				Waikato		
					Port Charles	1.8-3.6
				Gisborne		
					Gisborne	0.6-2.5
				Hawkes Bay		
					Napier	1.5- 3
					Wairoa	0.7
				Wellington		
					Wellington	1.5
				Canterbury		
					Waitangi	1
					Pigeon Bay	1.25-2
					Christchurch	0.9
					Waimakariri River	
					Avon River	0.9
					Kaiapoi	0.9
					Timaru	1
					Akaroa	2.5-3
					LeBons Bay	2

				Lyttleton		
				Otago		
				Oamaru	1.5-3	
				Port Chalmers	0.1	
				Kaitangata	1.2	
				Southland		
				Bluff	1.2-1.5	
				West Coast		
				Westport	1.5-1.8	
				Jackson Head	2	
				Chatham Islands		
1883	27-Aug	Krakatua, Indonesia	Volcanic & I Meteorological	**Northland**		TL, DH, AF, T, N, R
				Mangonui	1.5	
				Russell	1.5	
				Warkworth	1.2	
				Auckland		
				Auckland	1.8	
				Waikato		
				Coromandel	0.9	
				Whitianga	1.8	
				Tairua	1.8	
				Thames	1.5	
				Bay of Plenty		
				Maketu	0.9	
				Gisborne		
				Gisborne	0.9	
				Canterbury		
				Lyttleton	1.8	
				Timaru	1	
				Otago		
				Port Chalmers	0.6	
1887	10-May	Bay of Islands, NZ	EQ	**Northland**		TL
				Bay of Islands	2	
1891	22-Jun	Aotea, NZ, Waikato Heads	EQ	**Waikato**		TL, DH, AF, T, N
				Aotea Harbour	3	
1897	21-Sep	W. Mindanao, Sulu, Philippines	8.5 EQ	**Wellington**		TL, N
				Wellington		
1897	21-Sep	Wellington, NZ	EQ	**Wellington**		TL, DH
				Wellington	1	
1904	7-Aug	Cape Turnaga, NZ	7.2-7.5 EQ	**Manawatu-Wanganui**		TL, DH, T
				Wanganui	3	

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Appendix 2

Surveys and Letters

Summer Visitor Survey

Tsunami Survey Questions

Interview by: Date: Location:

Personal Information

1. Are you an overnight camping visitor, camping visitor for an extended period (camping for more than 2 weeks), a day visitor, or an employee?

2. How many days per year on average do you visit?

3. How many years have you been visiting?

4. Are you from the Canterbury Region, New Zealand, or abroad?

5. Male or Female

6. Age group:
□18- 20 □ 20s-30s □ 30s-40s □ 40s-50s □ 50+

7. How much time do you spend in the near shore environment?
□ At least some time □ Once a week □ Daily □ None

8. What activities do you engage in while at the coast?

9. Have you had any previous personal experience of a tsunami?

Knowledge of Risk

10. What do believe likely natural hazards to affect this area are?

□ None □ Landslide □ Earthquake □ Tsunami □ Wildfire □ Flooding □ Volcano
□ Coastal Erosion □ other _____

11. How likely do you think it is that the following natural hazards could affect this area:

1 = definitely not affect – 5 = definitely affect

Landslide
Earthquake
Tsunami
Wildfire
Flooding
Volcano
Coastal Erosion

Or no natural hazards will affect this area □
12. When was the last tsunami that caused damage in Banks Peninsula?

□ Never □ Within the last year □ In the last 1-10 years □ In the last 10-100 years
□ In the last 100-1000 years □ Don't know

13. Do you think that a tsunami could occur:

□ While you are visiting □ Within the year □ In the next 1-10 years
□ In the next 10-100 years □ Not within 100 years □ Never

Preparation and Warnings

14. Have you

a) actively sought information about this area and/or

b) heard or received information about tsunamis from any of the following sources?

(List under (a) and (b))

a b
□ □ Friends or Family
□ □ Central Government
□ □ Civil Defense
□ □ Local Council
□ □ Regional Council
□ □ Business establishment
□ □ Child's school
□ □ Research organization (e.g. GNS, University)
□ □ Other_____

15. Where do New Zealand tsunamis come from?

16. Who do you think is responsible for issuing distant-source tsunami warnings to you?

□ Don't know □ Central Government □ Regional Council □ Local Council
□ Civil Defense □ Local Police or Fire Service □ NIWA □ GNS □ No one can
□ No one should □ Other _____

17. Who do you think is responsible for issuing local-source tsunami warnings to you?

□ Don't know □ Central Government □ Regional Council □ Local Council
□ Civil Defense □ Local Police or Fire Service □ NIWA □ GNS □ No one can
□ No one should □ Other _____

18. Does New Zealand have a tsunami warning system?

19. What does the New Zealand public warning notification system consist of?

20. Which do you think would be the most effective way of delivering a warning?

21. What are the natural signs of a tsunami, or the signs that a tsunami might have been generated?

During a Tsunami

22. In the event of a distant source, official tsunami warning, what actions would you take?

23. In the event of signs of a possible local-source tsunami, what actions would you take?

24. If you are at the coast and receive an official tsunami warning how much time do you have to move to safety?
□ Don't know □ A few minutes □ 10 minutes to a half an hour □ 1-2 hours
□ 2-5 hours □ more than 5 hours □ I will follow instructions

25. If you feel a strong earthquake while at the beach, how much time do you have to move to safety?
□ Don't know □ A few minutes □ 10 minutes to a half an hour □ 1-2 hours
□ 2-5 hours □ more than 5 hours

26. What do expect from campground/accommodations staff during a tsunami?

Changes in Perception

27. Did you know what a tsunami was before the 2004 Boxing Day tsunami?

28. Since the 2004 Boxing Day tsunami you:
□ Have learned more about tsunamis □ Have actively sought more information on tsunamis □ Feel more at risk from tsunamis □ Feel less at risk
□ Have not been affected □ Other _____

September 2006

Information for participants
Dear householder,

GNS Science is conducting a national study of community beliefs about natural hazards, with a special focus on tsunami hazards. The findings from the study will be used to help local communities better prepare for future extreme events.

In **2003** your household was randomly selected to participate in a coastal survey. If the person who participated in that study is still a resident at this address, **we invite them to please complete this new questionnaire**. **Otherwise**, if the 2003 respondent no longer lives here, then the person who should complete this questionnaire is **the adult (age 18 or older) who most recently had a birthday**.

All replies will be confidential, and we will only report on general trends. You are not asked to record your name. Filling in the questionnaire implies that you are consenting to participate. Completing the questionnaire should take about 15 minutes or so of your time. When you have completed it, please put it in the enclosed Freepost envelope and post it.

Your views are very important to the success of this study, and we look forward to hearing from you.

Dr David Johnston
GNS

For further information, please contact Dr David Johnston at:
Phone: 04-570 1444 or
Email: david.johnston@gns.cri.nz

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All replies will be confidential, and we will only report on general trends. You are not asked to record your name. Filling in the questionnaire implies that you are consenting to participate. Completing the questionnaire should take about 15 minutes or so of your time. When you have completed it, please put it in the enclosed Freepost envelope and post it.

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November 2006

Dear householder,

Recently you received a questionnaire as part of a study of tsunami hazards in New Zealand. Findings from the study will be used to help local communities become more effectively involved in coastal issues. If you have already completed and returned the questionnaire we would like to take this opportunity to thank you.

If not, we hope you will be able to assist us by completing the questionnaire and returning it to us in the Freepost envelope enclosed. Your views are very important to the success of this study, and we look forward to hearing from you.

To understand the range of community views, we need responses from many different types of people - women and men, young and old. In your household, the person who should complete this questionnaire is the **adult (age 18 or older)** who most recently had a birthday.

All replies will be confidential, and we will only report on general trends. You are not asked to record your name. Filling in the questionnaire implies that you are consenting to participate. Completing the questionnaire should take about 15 minutes or so of your time. When you have completed it, please put it in the enclosed Freepost envelope and post it.

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2006
National Coastal Survey

Awareness and experience of natural hazards in general.

1. Which are the **two natural hazards** that you think are most likely to affect this community? (Tick two only)

- ☐ 1 Ash fall from a volcanic eruption
- ☐ 2 Coastal erosion (shoreline erosion)
- ☐ 3 Earthquake
- ☐ 4 Flooding (river or storm surge)
- ☐ 5 Forest or bush fire
- ☐ 6 Landslide
- ☐ 7 Storm or cyclone with high winds
- ☐ 8 Tsunami (previously called tidal wave)

2. Have you ever been affected by any of the following events? (Tick all that apply)

- ☐ 1 Chemical spill or gas leak
- ☐ 2 Climate change
- ☐ 3 Earthquake
- ☐ 4 Fire
- ☐ 5 Flood
- ☐ 6 Infrastructural failure (e.g. loss of electricity)
- ☐ 7 Landslide
- ☐ 8 Pandemic
- ☐ 9 Storm with high winds (e.g. cyclone)
- ☐ 10 Tornado
- ☐ 11 Volcanic eruption
- ☐ 12 No events have affected me **(If "No events", go to Question 3)**

2a. **<u>If you have been affected</u>**, to what extent were you affected? (considering property damage, injuries and financial impact). In each row please **<u>tick the one</u> <u>number</u> <u>you feel best represents this impact,</u>** on the scale from 1 to 10.

	Little impact ← → Severe impact									
	1	2	3	4	5	6	7	8	9	10
Chemical spill or gas leak	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
Climate change	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
Earthquake	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
Fire	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
Flood	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
Infrastructural failure	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
Landslide	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
Pandemic	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
Storm with high winds (e.g. cyclone)	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
Tornado	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10
Volcanic eruption	☐1	☐2	☐3	☐4	☐5	☐6	☐7	☐8	☐9	☐10

<u>General tsunami questions</u>

3. What is the most frequent cause of tsunamis in general? (Tick one only)

- ☐1 Landslide
- ☐2 High tide
- ☐3 Hurricane/storm
- ☐4 Earthquake
- ☐5 Volcanic eruption
- ☐6 Don't know

4. Tsunami waves can occur as which of the following: (Tick all that apply):

- ☐1 One big wave/surge
- ☐2 Multiple big waves/surges
- ☐3 One small wave/surge
- ☐4 Multiple small waves/surges
- ☐5 Multiple big waves/surges and multiple small wave/surges
- ☐6 Rapidly rising and falling water level
- ☐7 Don't know

5. When was the last tsunami that affected this community? (Tick one only)

- ☐ 1 Never
- ☐ 2 In the last 10 years
- ☐ 3 In the last 100 years
- ☐ 4 In the last 1000 years
- ☐ 5 In the last 10 000 years
- ☐ 6 Don't know

6. When was the last ***damaging*** tsunami that affected this community? (Tick one only)

- ☐ 1 Never
- ☐ 2 In the last 10 years
- ☐ 3 In the last 100 years
- ☐ 4 In the last 1000 years
- ☐ 5 In the last 10 000 years
- ☐ 6 Don't know

7. Do you think that a tsunami could occur: (Tick one only)

- ☐ 1 Within the year
- ☐ 2 In the next 1-10 years
- ☐ 3 In the next 10-100 years
- ☐ 4 Not within 100 years
- ☐ 5 Never
- ☐ 6 Don't know

Tsunami warnings and preparation

8. Have you seen any tsunami hazard zone maps for this community? (Tick one only)

- ☐ 1 Yes
- ☐ 2 Not sure
- ☐ 3 No

9. Do you live in a tsunami inundation (hazard or danger) zone? (Tick one only)

☐ 1 Yes
☐ 2 No
☐ 3 Don't know

10. Which of the following make up the New Zealand's public tsunami warning system? (Tick all that apply).

☐ 1 Don't know
☐ 2 Sirens
☐ 3 Loud speaker announcements
☐ 4 Flashing lights
☐ 5 Radio and TV announcements
☐ 6 Door–to-door visits by emergency services or civil defence staff
☐ 7 Other (please specify) _____

11. What do **you** think would be the most effective way of delivering a warning?

_____
_____
_____

12. Who is responsible for issuing tsunami warnings? (Tick all that apply).

☐ 1 Don't know
☐ 2 Central Government
☐ 3 Regional Council
☐ 4 Local Council
☐ 5 Local Civil Defence group
☐ 6 Police or Fire Service
☐ 7 NIWA or GNS
☐ 8
Other_____
_____

13.* The following is a list of signs that might alert you of an arriving ***local*** source tsunami (from a place less than 1 hour travel time away). Rate how unlikely or likely each sign will occur. (Tick one per line)

Sign	Unlikely	Maybe	Likely
a. Siren sounding	☐	☐	☐
b. Loudspeaker/bullhorn from Civil Defence/ Police	☐	☐	☐
c. TV or radio broadcast	☐	☐	☐
d. Relative, friend, or neighbour	☐	☐	☐
e. Ground shaking from an earthquake	☐	☐	☐
f. Sea-level draw down (receding ocean)	☐	☐	☐
g. Unusual waves (wall of water, breaking wave, etc)	☐	☐	☐
h. Unusual sounds	☐	☐	☐

14.* Now, consider the same signs as above, but rate how unlikely or likely each sign will occur for an arriving ***distant*** source tsunami (originating from Japan or Alaska, etc). (Tick one per line)

Sign	Unlikely	Maybe	Likely
a. Siren sounding	☐	☐	☐
b. Loudspeaker/bullhorn from Civil Defence/ Police	☐	☐	☐
c. TV or radio broadcast	☐	☐	☐
d. Relative, friend, or neighbour	☐	☐	☐
e. Ground shaking from an earthquake	☐	☐	☐
f. Sea-level draw down (receding ocean)	☐	☐	☐
g. Unusual waves (wall of water, breaking wave, etc)	☐	☐	☐
h. Unusual sounds	☐	☐	☐

***These questions were not included in the analysis because the data was not valid due to a misprinting. Only seven boxes are available instead of eight.**

15. To what extent do you agree that: (Tick one for each statement)

	Strongly disagree ←		*(scale)*		Strongly agree →
Tsunami are too destructive to bother preparing for	☐	☐	☐	☐	☐
A serious tsunami is unlikely to affect me in the future	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
It is unnecessary to prepare for tsunami as assistance will be provided by local/regional councils or Civil Defence	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Preparing for tsunamis is inconvenient for me	☐	☐	☐	☐	☐
It is difficult to prepare for tsunamis	☐	☐	☐	☐	☐
Preparing for tsunamis will reduce damage to my home	☐	☐	☐	☐	☐
Preparing for tsunamis will improve my everyday living condition	☐	☐	☐	☐	☐
Preparing for tsunamis will improve my ability to deal with disruption to family/community life	☐	☐	☐	☐	☐
Preparing for tsunamis will help save lives	☐	☐	☐	☐	☐
I do not know how I can prepare for a tsunami	☐	☐	☐	☐	☐

16. Have you **heard or received** any information about preparing for tsunami hazards from any of the following? (Tick all that apply).

- ☐ 1 I haven't heard or received any information
- ☐ 2 Friends
- ☐ 3 Neighbours
- ☐ 4 Relatives
- ☐ 5 Central government
- ☐ 6 Regional Council
- ☐ 7 Local Council
- ☐ 8 Local Civil Defence group
- ☐ 9 Business establishments
- ☐ 10 Research organisations (e.g. NIWA, GNS, universities)
- ☐ 11 My workplace
- ☐ 12 My child's school
- ☐ 13 Other, specify _____

17..... In the next month or so, do you intend to: (Tick one for each statement)

	No	Possibly	Definitely
Improve your knowledge of how to respond to tsunamis	☐ 1	☐ 2	☐ 3
Increase your ability to respond to tsunamis	☐ 1	☐ 2	☐ 3
Become involved with a local group/neighbourhood to discuss how to respond to tsunamis	☐ 1	☐ 2	☐ 3
Seek information on tsunami risks	☐ 1	☐ 2	☐ 3
Seek information on things to do to respond to tsunamis	☐ 1	☐ 2	☐ 3

18. Have you **asked** any of the following people, groups or organisations for information on how to get ready for tsunami hazards? (Tick all that apply).

☐ 1 No, I haven't asked anyone
☐ 2 Friends
☐ 3 Neighbours
☐ 4 Relatives
☐ 5 Central Government agencies
☐ 6 Regional Council
☐ 7 Local Council
☐ Local Civil Defence group
☐ 9 Business establishments
☐ 10 Research organisations (e.g. NIWA, GNS, universities)
☐ 11 My workplace
☐ 12 My child's school
☐ 13 Other, specify _____

19. Are there official tsunami evacuation routes for this community? (Tick one only)

☐ 1 Yes

☐ 2 No

☐ 3 Don't know

19a. If **yes** please describe

_____

_____

19b. If **no** do you think that an official evacuation route should be established? (Tick one only)

☐ 1 Yes

☐ 2 No

20. Are you currently becoming more "tsunami prepared"? (Tick one only)

☐ 1 Yes

☐ 2 No

☐ 3 Don't know

21. Which of the following steps have you taken or are taking to become more tsunami prepared? (Tick one per line)

	No	Yes	Does not apply
a. Developing a family emergency response plan	☐	☐	☐
b. Have a back pack filled with supplies that is ready to take with me	☐	☐	☐
c. Participated in an official tsunami evacuation drill	☐	☐	☐
d. Participated in an unofficial tsunami evacuation drill	☐	☐	☐

22. Please indicate how much you agree or disagree that the following sources of information influenced your willingness to prepare. (Tick one per line)

	Strongly Disagree		⟷		Strongly Agree
a. Public educational meetings	☐	☐	☐	☐	☐
b. World events such as the 2004 Indian Ocean tsunami	☐	☐	☐	☐	☐
c. Neighbourhood educators (door to door)	☐	☐	☐	☐	☐
d. School programs	☐	☐	☐	☐	☐
e. Council newsletters	☐	☐	☐	☐	☐
f. Public tsunami drills	☐	☐	☐	☐	☐

23. Did you know what a tsunami was before the 2004 Boxing Day Tsunami? (Tick one only)

☐$_1$ Yes
☐$_2$ No

24. Since the 2004 Boxing Day Tsunami you: (Tick all that apply)

☐$_1$ Have learned more about tsunamis
☐$_2$ Have actively sought more information on tsunamis
☐$_3$ Feel more at risk from tsunamis
☐$_4$ Feel less at risk from tsunamis
☐$_5$ Have not been affected
☐$_7$ Other,
please specify_____

During a tsunami

25. Describe how you would respond to a warning of a ***local*** source tsunami (from a place less than 1 hour travel time away).

_____
_____
_____

26. Describe how your response to a warning of a ***distant*** source tsunami (originating from Japan or Alaska, etc) would differ from your response to a local tsunami.

_____
_____
_____

27. If you are at the coast and receive an official tsunami warning how much time do you have to move to safety? (Tick one only)

- ☐ 1 Don't know
- ☐ 2 A few minutes
- ☐ 3 10 minutes to half an hour
- ☐ 4 Half an hour to one hour
- ☐ 5 1-2 hours
- ☐ 6 2-5 hours
- ☐ 7 More than 5 hours

28. If you feel a strong earthquake while at the beach, how much time will you have to move to safety? (Tick one only)

- ☐ 1 Don't know
- ☐ 2 A few minutes
- ☐ 3 10 minutes to half an hour
- ☐ 4 Half an hour to one hour
- ☐ 5 1-2 hours
- ☐ 6 2-5 hours
- ☐ 7 More than 5 hours

29. During a tsunami, how much time can there be between one tsunami wave/surge and the next? (Tick one only)

☐ 1 1-15 minutes
☐ 2 16-30 minutes
☐ 3 Over 30 minutes
☐ 4 All of the above
☐ 5 Don't know

30. Would you take personal belongings with you during a **local** source tsunami warning? (Tick one only)

☐ 1 Yes
☐ 2 No
☐ 3 Don't know

31. Would you take personal belongings with you during a **distant** source tsunami warning? (Tick one only)

☐ 1 Yes
☐ 2 No
☐ 3 Don't know

32. If you currently have personal survival belongings stored to take with you when a tsunami warning is issued, please list the three most important of these items to your health/welfare?

1. _____

2._____

3._____

33. For each statement, tick the box which best describes your response:

	Strongly disagree ← *(scale)* → Strongly agree				
I think tsunami could pose a threat to my personal safety	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I think tsunami could pose a threat to my daily activities (such as work, leisure or property)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
The tsunami that may occur here won't be that bad	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Tsunamis won't affect this area	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Tsunamis won't affect me	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
The likelihood that major tsunamis will occur here has been greatly exaggerated	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Tsunamis have affected this area since I have lived here	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I will be fine if any tsunami hits here in the future	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

34. Please list the component's of your community's tsunami warning system? (Please be specific)

_____

_____

_____

☐ I do not know if my community has a tsunami warning system.

☐ My community has a warning system, but I do not know the components of it.

35. What advice have you been given about what to do during a **tsunami evacuation**? (Please be specific) _____

_____

_____

If you do not have a school aged child or children (year 1-13) then skip to question 38

36. Does your child's school have a disaster preparedness plan that includes tsunamis? (Tick one only)

☐ 1 Yes
☐ 2 No
☐ 3 Don't know

37. Please indicate the extent to which you agree or disagree with each of the following statements:

	Strongly Disagree				Strongly Agree	Does not Apply
a. I will allow my child to remain at school when a tsunami **warning** is issued	☐	☐	☐	☐	☐	☐
b. I will go and get my child from school when a tsunami **warning** is issued	☐	☐	☐	☐	☐	☐
c. I trust that the tsunami preparedness plan at my child's school will protect my child during a tsunami event	☐	☐	☐	☐	☐	☐

Attitude about community

38. Relating to the householder who is answering this questionnaire are you:

☐ 1 the owner and this is your primary residence
☐ 2 renting and this is your primary residence
☐ 3 the owner and this is your holiday home
☐ 4 renting and this is your holiday home
☐ 5 visiting but neither rent nor own

If you live in this community please answer questions 39, 40, and 41.
If you are visiting this community, please answer questions 42 and 43.

39. Following is a list of statements on how you feel about living in this community. Please use the scale below to show how much each statement matches your views. (Tick one per line)

	Strongly disagree ← (scale) → Strongly agree				
	1	2	3	4	5
I feel 'at home' in this community	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I am satisfied living in this community	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I am a useful member of this community	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I have the same values and beliefs as my neighbours	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I feel I don't belong in this community	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I am interested in knowing what goes on in this community	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I would be happy to leave this community	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I know my neighbours and/or other community members	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I have no active involvement in this community	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

40.* Please think about your life in this community at present. Choose a number from the scale below that shows how much you agree or disagree with each of the following statements. (Tick one per line)

	Strongly disagree ← (scale) → Strongly Disagree				
	1	2	3	4	5
I feel I have control over the things that happen in my life	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I feel I have control over the things that happen in this community	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
There is no way I can solve some of the problems I have by myself	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I can't do much to change what happens in my life	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I can't do much to change what happens in this community	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
Somehow problems in my life usually solve themselves	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

*** This question was not included in the analysis due to misprinting of the scale.**

41. What are your main reasons for choosing to **live in** this community? (Choose the TWO most important reasons from the list below).

- ☐ 1 The natural beauty of the coast
- ☐ 2 Sea views
- ☐ 3 Escape from city life
- ☐ 4 Easy access to the beach
- ☐ 5 Fishing and shellfish gathering
- ☐ 6 Boating
- ☐ 7 Recreation (swimming, surfing, walking etc)
- ☐ 8 Sunbathing
- ☐ 9 Other (please describe)_____

If you are visiting this community, please answer questions **42** and **43**.

42. How often do you visit **this community**? (Tick one only)

- ☐ Very infrequently (once a year or less)
- ☐ Infrequently (2-3 times per year)
- ☐ Frequently (4-6 times per year)
- ☐ Very frequently (at least 6 times per year)

43. What are your main reasons for visiting this community? (Choose the TWO most important reasons from the list below).

- ☐ 1 The natural beauty of the coast
- ☐ 2 Sea views
- ☐ 3 Easy access to the beach
- ☐ 4 Fishing and shellfish gathering
- ☐ 5 Boating
- ☐ 6 Recreation (swimming, surfing, walking etc)
- ☐ 7 Sunbathing
- ☐ 8 Other (please describe)_____

All respondents please answer question **44** onwards.

44. To what extent do you agree or disagree with the following statements? Please use the scale below to show much each statement matches your views.

.

	Strongly disagree ← **(scale)** → **Strongly agree**				
	1	**2**	**3**	**4**	**5**
I feel at home in this community	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I know the neighbours	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I am interested in community events	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5
I am interested in local environmental issues (e.g. rubbish disposal, beach water quality)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5

45. Are you involved as a volunteer with any of the following in this community? (Tick all that apply)

☐ 1 Fire Brigade
☐ 2 Civil Defence
☐ 3 Search and Rescue
☐ 4 Surf Lifesaving
☐ 5 Rural fire patrol
☐ 6 Other (please specify)_____

46. Has your household done any of the following to prepare for a hazard or emergency? (Tick all that apply). If you are a **visitor** to this community, questions **46** and **47** apply to your usual home.

☐ 1 Have a working flashlight
☐ 2 Protected breakable household items
☐ 3 Put strong latches on cabinet doors
☐ 4 Stored hazardous materials safely
☐ 5 Added edges to shelves to keep things from sliding off
☐ 6 Strapped water heater
☐ 7 Installed flexible tubing to gas appliances
☐ 8 Bolted house to foundation
☐ 9 Stockpiled water and food for three days
☐ 10 Have a working portable radio and spare batteries
☐ 11 Have a working fire extinguisher
☐

☐ 12 Have a working smoke detector
☐ 13 Have a first aid kit
☐ 14 Stored wrench near gas turn-off valve
☐ 15 Picked an emergency contact person outside of your local area
☐ 16 Someone in family has learned how to put out fires
☐ 17 Bought additional insurance (e.g. home)
☐ 18 Someone in family has learned to provide first aid
☐ 19 Found out if you are in an area particularly vulnerable to a disaster (such as an earthquake, flood or tsunami)
☐ 20 Have had home inspected for preparedness
☐ 21 If you are a visitor have you checked for emergency supplies where you are staying
☐ 22 Talked to family members about what to do if a tsunami hazard warning is heard

47. How often do you check your emergency supplies like food, water and batteries? (Tick one only)

☐ 1 Weekly
☐ 2 Monthly
☐ 3 Yearly
☐ 4 Never

48. If you are visiting this community where is your usual place of residence?

_____

49. If you **live** in this community:

a) How long have you lived in this community? _____ Years

b) How long have you lived in your current home? _____ Years

If you are **visiting** this community:

c) How long are you visiting this community? ___days __ weeks

Demographics

The final set of questions concerns information about yourself. The information will be treated with complete confidence, and we will only report on general trends. We need this information to determine how representative our sample is of the general population.

50. Are you? (Tick one only)

☐ 1 **Male**
☐ 2 Female

51. Which best describes the situation you are living in now? (Tick one only)

☐ 1 Family with children
☐ 2 Family without children
☐ 3 Alone
☐ 4 With non-family
☐ 5 Other, specify _____

52. To which ethnic group do you belong? (Tick one only)

☐ 1 New Zealand European
☐ 2 Māori
☐ 3 Pacific Island
☐ 4 Chinese
☐ 5 Indian
☐ 6 Other : (please state)

53. How old were you on your last birthday? (Please fill in): _____ years

54. What is your current employment status? (Tick one only)

☐ 1 Employed full-time
☐ 2 Employed part-time
3 ☐ ot in paid employment
☐ 4 Self-employed

55. What is your household's gross annual income? (Tick one only)

☐ 1 Under $5,000
☐ 2 $5,000 to $15,000
☐ 3 $15,001 to $20,000
☐ 4 $20,001 to $30,000

☐ 5 **$30,001 to $40,000**
☐ 6 $40,001 to $50,000
☐ 7 $50,001 to $60,000
☐ 8 $60,001 to $90,000
☐ 9 $90,001 to $150,000
☐ 10 $150,001 to $200,000
☐ 11 Over $200,001

56. What is your highest educational qualification? (Tick one only)

☐ 1 No school qualifications
☐ 2 Secondary school qualifications
☐ 3 Trade certificate or professional certificate or diploma
☐ 4 University undergraduate degree (such as a Diploma or Bachelors degree)
☐ 5 University postgraduate degree (such as a Masters degree or Doctorate)

Thank you for taking the time to complete this questionnaire.

Please post the questionnaire in the envelope provided.

Appendix 3

Answers to open ended questions and “other” answers

Summer Visitor Survey

4. Are you from Canterbury Region, New Zealand, or abroad?	*n*
Auckland	2
Cambridge, Waikato	1
Dunedin	1
Germany	1
Hamilton	1
North Island	1
Palmerston North	1
Southland	2
UK	3
Wellington	2
West Whales	1

8. What coastal activities do you engage in while at the coast?	*n*
biking	1
biking, kayaking	1
biking, walking, swimming, kayaking	1
boarding, biking, walking, sunbathing	1
boat tour, fishing	1
boating fishing	2
boating, fishing, snorkelling	1
boating, fishing, swimming	1
boating, kayaking	2
boating, walking, swimming	1
boating, water skiing, fishing	1
boating, water skiing, sunbathing	1
boating, waterskiing, fishing	1
buggie boarding, swimming	1
camping	8
camping, fishing, walking	1
camping, jet skiing	1
camping, swimming, walking, biking	1
camping, walking	1
crab hunting, fishing, swimming	1
cycling	1
fishing	4
fishing, boating, jet skiing, kids playing at the beach	1
fishing, boating, walking	1
fishing, drag netting	1
fishing, seeing the dolphins	1
fishing, swimming	1
fishing, swimming, canoeing	1
fishing, swimming, kayaking	1
fishing, walking	2
fishing, walking, sailing	1
fishing, walking, swimming	1
fishing, water skiing	1
fishing, water skiing, diving	1
fishing, kayaking, swimming	1

go to the beach, swimming, boarding	1
golf, swimming, reading	1
hang out at the beach, fishing, walking, swimming	1
harbour cruise	1
jet skiing	1
kayaking	2
kayaking, fishing, swimming	1
kayaking, sailing, swimming, boating	1
kayaking, swimming, fishing	1
kayaking, swimming, walking	3
kayaking, walking	1
look after kids	1
mini golfing, swimming	1
paddle with kids, fishing, walking	1
paddling	2
paddling, walking, swimming	1
playing with kids, swimming, walking, biking	1
relaxing, playing with kids, biking	1
read	1
relax	2
relaxing	1
relaxing, swimming, kayaking	1
running, cycling, swimming, fishing	1
sail, swimming	1
sailing, boating	1
sailing, fishing, cycling, walking	1
sailing, walking	1
swimming sunbathing	1
snorkelling, swimming, fishing, body boarding	1
sunbathing, swimming, walking	1
surf casting, fishing	1
surfing, snorkelling, swimming, windsurfing	1
surfing, swimming, frisbee	1
swim, cricket, frisbee, bike	1
swim, fish, flounder, boat, relax, walk	1
swimming, playing in the sand, wave boarding	1
swimming	17
swimming body boarding	1
swimming fishing	1
swimming fishing, kayaking	1
swimming, biking	2
swimming, biking, boating, row boat	1
swimming, biking, walking	1
swimming, boarding	1
swimming, boating, kayaking, fishing, hiking, walking	1
swimming, body boarding, shell fishing	1
swimming, buggie boarding, fishing	1
swimming, canoeing	1
swimming, canoeing, walking, cycling	1
swimming, fishing	1
swimming, fishing, biking, walking, kayaking	1
swimming, fishing, boarding, biking	1
swimming, fishing, canoeing	1

swimming, fishing	1
swimming, jet skiing, relaxing	1
swimming, kayaking	1
swimming, kayaking, biking, go karts	1
swimming, paddling	1
swimming, people watching, sightseeing, boating	1
swimming, playing with kids	1
swimming, relaxing	1
swimming, sunbathing	3
swimming, surfing	1
swimming, surfing, walking	1
swimming, walking	5
swimming, walking, fishing	1
swimming, walking, playing with kids	1
swimming, walking, touring	1
tennis, walking	1
time with kids	1
touring	1
visit ocean front	1
walking	14
walking, biking	1
walking, biking, swimming	1
walking, fishing, swimming	1
walking, swimming	5
walking, swimming, boat tour	1
walking, swimming, canoeing, fishing	1
walking, swimming, fishing	1
walking, swimming, time with kids	1
walking, swimming, wave skiing, biking	1
walking, time with family	1
walking, time with kids, canoeing	1
walking, time with kids, swimming	1
water skiing, boarding, swimming	1
water sports	1
windsurfing, sailing, fishing	1
yachting	1

10. What do you believe likely natural hazards to affect this area are?	*n*
bad weather	1
beach, water	1
beach, wind	1
broken glass, trees falling	1
cars going to fast	1
coastal tides, storms	1
currents	1
don't know	6
drinking water	1
drowning	1
drowning, sunburn	1
drowning, water contamination, uneven ground	1
drowning, wind, children from cars	1
falling pine cones, trees, ocean	1
high winds	1

lack of water, pollution	1
lagoon, sea	1
minimal	1
north west wind	1
ocean	1
people, rubbish	1
peoples impact on the environment	1
pine cones, trees falling down	1
pollution in river, trees falling	1
pollution	1
prickles in grass	1
rain, wind, sea	1
rip currents	1
road	1
road hazards, speeding	1
rocks around sea, southerlies	1
rocks, trees falling	1
rough sea	1
sea	1
sea goes up	1
sea, drowning	1
sea, river	1
sea, trees	1
sea, trees when windy	1
shell fish	1
snowfall	1
southerly wind	1
southerly winds	1
sticks on the ground	1
storm, sunburn	1
storm, tree falling from wind	1
storm, trees falling	1
storms	2
storms, wind	1
storm, trees falling, wind	1
storms	1
sun	1
sun, water- swimming, storms	1
sunburn	2
tidal wave	3
tidal wave, seagull poop, wind, infection, unclean water	1
tordanoes, hurricanes	1
tornado	1
traffic, rubbish	1
trees	10
trees blowing down	1
trees falling	2
trees falling from wind	1
trees falling, people speeding on motorbikes	1
trees falling, water	1
trees in wind	2

trees with wind, rabbit holes in the dark	1
trees, sea	1
trees, water- drinking, sun	1
trees, water safety	1
trees, wind	1
trees, wind, water	1
walking	1
water	3
water from the lagoon, trees	1
water pollution, storms	1
water restrictions, rip current	1
water, kids on road	2
water, sea, jet skis, boating, drowning	1
weather	2
weather, sea	1
weather, trees falling, rip currents, current in lagoon	1
weather, wind	1
weather conditions, boating accidents	1
wind	18
wind, heavy rain	1
wind, rain	1
wind, storms	1
wind, trees	1
wind, water	1
windy conditions	1

14a. Have you sought information about this area?	*n*
for work as a school teacher	1
internet, TV, History channel	1
library, from friend who experience Boxing Day tsunami	1
museum	1
news	2
newspaper, Listener, internet	1
Newspaper, The Press	1
pamphlet	1
people came to talk at club	1
police flyer	1
school report	1
signs	1
TV	1
work (Telecom)	1

14b. Have you heard or received information about tsunami from any of the following sources?	*n*
ECAN	2
EQC	2
EQC, phonebook	1
mailer	1
media	3
media, TV	1
meeting at home	1
museum, paper	1

news	8
news, phonebook	1
news, TV	1
newspaper	4
newspaper, EQC	1
newspaper, Listener	1
newspaper, made plan for preschool	1
newspaper, media	1
newspaper, phonebook	1
newspaper, TV	1
newspaper, TV, internet	1
newspaper, web	1
paper	7
paper, news, media	1
paper, The Press	1
papers	1
papers, media	1
phonebook	5
radio	1
radio, TV	1
radio, EQC	1
The Press	1
though work in insurance company	1
TV	6
TV, newspapers	1
TV, papers	1
TV, phonebook	1
yellow pages	1
yellow pages, red cross	2

15. Where do New Zealand tsunamis come from?	*n*
across the Pacific	1
America	1
America, Pacific islands	1
Americas	1
Antarctic	1
any direction	1
anywhere in the world	1
anywhere, far or local	1
anywhere, Pacific, Indian Ocean	1
Argentina, Australia, Tasman Sea	1
Argentina, Pacific	1
Asian ring	1
Atlantic area	1
Australia, Asia, Pacific	1
Chile	6
Chile, earthquake locally	1
Chile, Pacific Ocean	1
Chile, South America	1
Chile, South America, anywhere from the Pacific rim	1
Chile, South America, Pacific plate	1

don't know	41
don't know, earthquakes	1
don't know, fault line in Pacific	1
don't know, Kaikoura	1
don't know, Pacific	2
don't know, Pacific Islands	1
don't know, sea	3
earthquake	2
earthquake at sea	1
earthquake from West Coast, South America, Kaikoura from landslide	1
earthquake in Chile	1
earthquake out of the sea	1
earthquake, Pacific	1
earthquake, shifting of plates	1
earthquakes	6
earthquakes from the Pacific	1
earthquakes on Pacific ring of fire	1
earthquakes, Pacific basin, Chile	1
earthquakes, South America, Pacific Ocean	1
far away	1
fault line off coast	1
Indian Ocean	2
Indonesia, here	1
Kaikoura	1
Kaikoura, Pacific	1
local earthquake	1
middle of the ocean	1
New Zealand Alpine Fault	1
New Zealand fault lines	1
New Zealand, across the Pacific, America, ring of fire	1
North	3
ocean	5
ocean, Argentina	1
ocean, earthquakes	1
offshore earthquakes, Asia, Pacific	1
offshore, Pacific	1
other side of the Pacific	1
out to sea	1
out to sea, island areas	1
Pacific	20
Pacific earthquakes	1
Pacific from an earthquake	1
Pacific Islands	1
Pacific Ocean	7
Pacific Ocean on the East Coast, Indian Ocean/Tasman Sea on the West Coast	1
Pacific Ocean plates	1
Pacific Ocean, South America	1
Pacific plates, islands, Australia, America	1
Pacific plates, Kaikoura	1
Pacific Region	1
Pacific rim	1
Pacific rim, Chile, ring of fire	1

Pacific shelf	1
Pacific towards America, South America	1
Pacific, South America	2
Papua New Guinea, South America, Chile, Pacific Region	1
Peru	1
Peru, any plate boundary	1
Portugal	1
sea	9
sea, Chile	1
sea, earthquake	2
sea, fault lines, tectonic plates, landslides	1
sea, Japan	1
sea, Pacific Ocean, Indian Ocean	1
sea, Pacific plates	1
sea, volcano under the sea, earthquake under the sea	1
South America	7
South America, Americas	1
South America, Chile	2
South America, Chile, landslide in Kaikoura	1
South America, Japan	1
South America, Pacific	1
South America, Pacific islands	1
South Pacific	2
Tasman	1
Tasman Sea, Pacific	1
Tasman, Pacific	2
tectonic plates in the Pacific	1
undersea earthquakes	1
volcanic rim, Pacific rim	1
water, earthquakes	1
West Coast	1
where plates are moving out at sea	1
White Island, Edgecomb Bay, Bay of Plenty, South America	1

16. Who do you think is responsible for issuing distant-source tsunamis warnings to you?	*n*
1st on site	1
1st person to see it	1
camp manager	1
camping people, emergency services	1
coast guard	3
coastguard, DOC	1
Country of origin	1
ECAN	2
emergency services	2
EQC	1
Helen Clark	2
Helen Clark, ECAN, Pacific warning from international organization	1
international group	1
international group with buoys	1
international monitor	1
international organization- U.S.	1
international organization	1

International tsunami watch	1
international warning system	2
met service	4
met service, DOC	1
meteorological office	1
no one does	1
Pacific early warning system	1
Pacific Tsunami Warning Center	2
Pacific warning center	1
Prime Minister	1
private enterprise	1
rangers in the area	1
scientist	1
Search and Rescue	1
some government department	1
someone with seismology	1
Tsunami warning place	1
TV weather	1
United Nations	1
US Center	1
warning from US or Fiji	1
watch center in Hawaii	1
weather forecasters	2
weather monitors	1
weather people	2
weather service	1
whomever knows it's happened	1

16. Who do you think is responsible for issuing local-source tsunamis warnings to you?	*n*
1st on site	1
1st person to see it	1
branch of government	1
camp manage	1
camping people, emergency services	1
coast guard	2
earthquake people, weather people, met service	1
ECAN	2
emergency services	2
EQC	1
Helen Clark	1
met service	3
met service, DOC	1
meteorological office	1
no one does	1
no would be able to	1
not possible	1
Prime minister	1
Prime Minister	1
scientist	1
someone with seismology	1
weather forecasters	2

weather monitors	1
weather people	2
weather service	1
whomever experiences the earthquake	1

19. **What does the New Zealand public warning notification consist of?**	*n*
3 blasts at the beach	1
alarm, radio	1
alarms	1
big long siren	1
buoys in water	1
broadcasting, radio, TV	1
Civil Defence	2
Civil Defence people, radio	1
Civil defence siren	1
Civil Defence siren	1
Civil Defence sirens, radio	1
Civil Defence sirens, radio, police	1
Civil Defence, radio, public address, local fire sirens	1
continuous blasts on siren	1
don't know	35
don't know, loud noise	1
don't know, radio	1
don't know, radio, media, TV, surf patrols	1
don't know, radio, siren	1
fire alarm going constantly, TXT	1
fire sire, radio	1
fire siren	1
fire siren, people- word of mouth	1
fire stations, radio, TV	1
floaty things out at sea	1
horns along coast	1
local siren, radio, word of mouth	1
loud blasts on a horn	1
media	1
media, radio, TV	1
media, TV, radio	2
news	1
news, radio	1
none	1
phone call	1
phone, radio, TV	1
phonebook	1
police cars with hailer, fire siren	1
police, radio	1
radio	37
radio, alarm	1
radio, cell phone	1
radio, cell phones	1
radio, Civil Defence people	1
radio, Civil Defence siren	1

radio, Civil Defence sirens	1
radio, local police verbally	1
radio, media	2
radio, media, siren	1
radio, police	1
radio, police at beach	1
radio, police vehicles with hailers	1
radio, siren	4
radio, sirens	2
radio, TV	23
radio, TV, Civil Defence siren	1
radio, TV, fire alarm	1
radio, TV, fire siren	1
radio, TV, fire sirens	1
radio, TV, loud speakers	1
radio, TV, media	2
radio, TV, siren	2
radio, TV, sirens	1
radio, TV, some places have sirens	1
radio, TV, telephone	1
radio, TV, word of mouth	1
radio, verbal, TV	1
radio, word of mouth, police	1
radio, newspaper	1
short beeps on radio	1
short toots on siren, radio	1
siren	11
siren, radio	1
siren, TV	1
siren, TV, radio	1
siren, TXT	1
sirens	7
sirens, word of mouth	1
telephone	1
things under sea that pick up tsunami	1
three alarms on siren	1
TV	1
TV, newspaper	1
TV, radio	2
TV, radio, fire sirens	1
TV, radio, helicopter	1
TV, radio, paper	1
TV, radio, word of mouth	1
TXT, fire alarm	1
weather broadcasting, TV	1
weather radio	1
word of mouth	1
word of mouth, radio, TV	1

20. What do you think would be the most effective way of delivering a warning?	*n*
air raid sirens	1
air waves	1
alarm	1
camp manager	1
campground managers	1
campground owners	1
campground personnel	1
campground using loudspeaker	1
caretaker	3
caretaker announcement, official vehicle driving around the beach, radio	1
cars with loud speakers through campground	1
cars with loudspeakers	1
cell phone	4
cell phone, radio, fire brigade	1
Civil Defence siren	1
cops with loud speaker driving around	1
distributing information to all households prior to event and using a siren which is different than the fire siren	1
DOC, campsite with loudspeaker	1
don't know	2
don't know, radio	1
emergency system in place	1
fire alarm	1
fire alarms	1
fire brigade sirens	1
fire siren	1
fire siren, radio	1
flares	1
local- not effective distant- radio, TV, police	1
loud hailer	2
loud speaker	2
loud speaker or PA	1
loud speaker, megaphone	1
loud speaker, police	1
loudspeakers at park	1
loudspeakers/hailer on a car	1
media	1
media, patrols through neighbourhood	1
media, TV	1
message via office	1
news	1
people in charge of campsite	1
people, word of mouth	1
phone	1
phone call	2
phone call to office and word of mouth	1
phone, TXT, news	1
police	2
police with hailers	1
police, word of mouth	1

populated beach have sirens/loudspeakers, information for area available i.e. notices at campground	1
radio	30
radio, cell phone, newspapers for longer term warning	1
radio, email	1
radio, loud siren	1
radio, news, TV	1
radio, newspaper, siren	1
radio, paper, siren	1
radio, people	1
radio, siren	5
radio, sirens	1
radio, TV	20
radio, TV broadcasts	2
radio, TV, cell phone	1
radio, TV, media	4
radio, TV, sirens	1
radio, TV, town announcement system	1
radio, TV, word of mouth	1
radio, TXT	1
radio, TXT, TV	1
radio, VHF	1
radio, word of mouth	3
same	2
school	1
signal or noise	1
siren	21
siren, loud speaker	1
siren, radio	1
siren, TV	1
siren, TXT, radio	1
siren, word of mouth	2
sirens	2
sirens separate from fire alarms	1
sirens, radio	1
speakers, caretaker, address campers, telephone tree	1
specialized siren	1
specialized siren, word of mouth	1
surf club, radio, TV, siren	1
three alarms on siren	1
through owner and word of mouth, siren	1
TV	4
TV, news	1
TV, newspaper	1
TV, radio	6
TV, radio, cell phones	1
TV, radio, newspaper, internet	1
TV, word of mouth, fire siren	1
TXT	2
TXT message	1
TXT message, separate siren	1

TXT, phone, word of mouth	1
TXT, radio	1
vehicle with hailer, PA system	1
VHF radio	1
water goes out	1
weather forecasters, TXT message, radio	1
word of mouth	3
word of mouth, alarm system	1
word of mouth, continuous	1
word of mouth, siren and notice for what siren is for	1

21. What are the natural signs of a tsunami, or signs that a tsunami might have been generated?	*n*
1 or more large waves	1
animal movement, huge wave	1
big swells	1
big wave	4
big wave coming	2
big wave coming in	1
big wave, earthquake	1
big wave, water retreating	1
big waves	1
big waves, pick up on wind	1
big withdrawal of the sea	1
bird leave, noise of water	1
birds go, water receding	1
birds going quiet, tide going out far, frothy water	1
change in waves, change in wind	1
change in weather, increase in tide, increase in volume of water	1
changes in tide	1
changes in water behaviour	1
coastal erosion, suck out beach, break water sucked out	1
current rushing out	1
don't know	8
draw back of water	1
earthquake	1
earthquake then horizon becomes unclear, then wall of water, water becomes murky before	1
earthquake, change in water	1
earthquake, sea going out	1
earthquake, water goes out, birds/ animals take off	1
earthquake, water receding	1
first tide leaves quickly	1
flooding, loss of life, water coming over	1
huge recession of the tide, tide goes out faster and further than normal	1
incoming tide	1
incoming wall of water, tide going out	1
increase of water level	1
increased wave action	1
large wall of water, earthquake tremors	1
large wave	1
large waves, debris	1

low tide get sucked out	1
negative wave first means water going back	1
no water	1
ocean goes out, ocean goes really still	1
ocean receding	1
people running to hills, large wave arriving	1
rain, big wave	1
receding water	1
recession of the sea	1
roaring sound	1
roaring sound from water	1
roaring thunder noise, water disappearing out	1
sea disappearing	1
sea disappears	1
sea drawing out	1
sea gets sucked out, big wave coming at you	1
sea getting sucked out	1
sea goes out a long way	1
sea goes out, very low tide	1
sea goes way out	1
sea heading out	1
sea recedes, earthquake	1
sea receding	2
sea receding a long way out	1
sea sucking out	1
sea withdrawing	1
see waves	1
sound of waves, sea going out	1
stillness, birds go quiet, water goes out	1
storms	1
stronger wind, earthquake, big wave	1
super low tide	1
swells, water sucked out	1
take water, get survival kit and head uphill	1
there are none, no prewarning	1
tidal change	1
tidal wave coming at you	1
tide disappearing out coming back really fast	1
tide disappearing, boats stranded on beach	1
tide drawing backwards	1
tide goes out	6
tide goes out a long way	1
tide goes out excessively, swell in the distance	1
tide goes out then water level goes higher	1
tide goes out unnaturally and stays out for longer than usual	1
tide goes out, large when comes in	1
tide goes out/ recedes	1
tide goes right out	1
tide goes right out, disappears	1
tide goes way out	1
tide goes way out, then big waves	1

tide going out	5
tide going out a long way	1
tide going out rapidly/dramatically	1
tide going out really quickly	1
tide going out then wave coming in	1
tide going out, earthquake	1
tide going out, earthquake, extreme wind	1
tide going out, rivers going low	1
tide going quickly a long way	1
tide going way out	3
tide going way out very fast	1
tide going way out, frothy water	1
tide recedes	1
tide recedes way out and then comes back	1
tide receding	2
unnatural low tide, initial abnormal low tide, water going out	1
wall of water	1
water's gone	1
water goes out	1
water being sucked out	2
water coming in a hurry	1
water disappearing	6
water disappearing backwards	1
water disappearing towards the sea a long way out	1
water disappears	3
water drawing out	1
water ebbs out and comes back in a big rush	1
water goes all the way out	1
water goes and comes back	1
water goes out	13
water goes out further than normal	1
water goes out, wall of water	1
water goes right out	3
water goes way out	1
water goes way out then thunders in	1
water goes way out, birds go out	1
water going back	1
water going out	10
water going out a long way	1
water going out and then back in	1
water going out past horizon	1
water going out, animals taking off	1
water going out, take a while to come back	1
water hisses and froths like in a pan	1
water recedes very far, big wave	1
water recedes	1
water recedes significantly	1
water receding	1
water receding real quick	1
water rising	1
water rushes out	1

water rushing out then in fast	1
water sucking out	4
water sucking out, big tidal change	1
water sucks back	1
water sucks out	1
water to recede	1
water will go out	1
waves disappearing further out	1
waves getting bigger	1
waves going out	1
waves recede, abnormally low tide	1

22. In the event of a distant source, official tsunami warning, what actions would you take?	*n*
alert campers to move to higher ground	1
at home make sure we had provisions and radio with batteries. at campground pack up kids and stuff and leave	1
clear out and head for higher ground	1
climb hill	1
climb the hill	1
climb up a tree	1
collect kids, get in car and drive away	1
don't know	2
drive as fast as you can, go uphill/ inland	1
drive uphill	1
ensure parents left, head up Cashmere hills at home, get in car and go here	1
evacuate	1
find high ground	1
find information on where it is safe to go	1
find out where highest point is and go there	1
follow instructions, move to higher ground	1
get as far away from beach as possible	1
get as high as possible	2
get away from camping places, notify people	1
get away from coast	1
get away from the beach	1
get cars out and go	1
get family together, head inland and up	1
get high, head for hills	1
get in car an go to higher ground	1
get in car an go, leave caravan	1
get in car and drive as far away as possible uphill	1
get in car and drive uphill	1
get in car and go	1
get in car and go, go high up	1
get in car, drive uphill 1-2 km away	1
get in car, go high, get in boat	1
get in the car with family and others if necessary and drive far away	1
get in van and go	1
get inland/uphill	1
get kids and go straight uphill	1
get kids and run, get up high	1

get kids, go high inland, bring survival kit	1
get kids/self in car and get to higher ground quickly, if no time then walk not use the car	1
get kinds and essentials into car and head uphill then watch it come in	1
get necessities and go far inland	1
get on bikes and go inland, vehicle transport too complicated	1
get out	1
get out of area, get inland	1
get out of here	2
get out of here to higher ground	1
get out of here, uphill	1
get out very quickly	1
get somewhere high	1
get supplies and get to higher ground	1
get to high ground	1
get to high ground as soon as possible	1
get to high ground, go as far inland as possible	1
get to high ground, nothing to do while at the coast	1
get to higher ground	7
get to higher ground or up a tree	1
get to higher ground, grab necessities	1
get to higher ground, make sure to have water, food, kids	1
get to higher ground, pack up a bit- valuables	1
get up high	1
get up to higher ground as fast as possible	1
get uphill	1
get uphill with camera	1
get water and food and organize, go where directed	1
go as far inland and uphill as possible	1
go as far inland as possible and uphill	1
go for high ground	1
go for higher ground	1
go for hills, get personal papers and family then go	1
go high up	1
go home	2
go inland	2
go inland, leave tent and stuff	1
go to high ground	2
go to high ground with a good view	1
go to high ground/ inland	1
go to higher ground	7
go to highest ground, to mom's	1
go to Mt. Hutt moving as far inland as possible	1
go up high	1
go up the hill	1
go up to higher ground	1
go up to hills	1
go uphill	4
go uphill as fast as possible with kids	1
go uphill as high as possible	1
grab kids and go uphill as quickly as possible	1
grab kids, move to higher ground	1

head for high ground	1
head for high land	1
head for higher ground	2
head for higher ground, take others with	1
head for hills	6
head for hills in car	1
head for hills or higher	1
head for hills with kids and animals	1
head for hills/foothills as quickly as possible	1
head for the hills	5
head for the hills, take water, batteries, food	1
head for the hills/ higher ground, leave stuff	1
head inland	4
head inland as far as possible and as quickly as possible	1
head to higher ground	1
head to hills	1
head up hill as soon as possible	1
head up the hill	1
high ground	1
jump in car and grab cats and food an go	1
jump in car and head inland	1
just go, no packing except essentials	1
leave area as fast as possible	1
leave as soon as heard about it	1
leave belongings and run away	1
leave campground and Christchurch	1
leave coastal area immediately	1
leave, take water and go inland with survival pack	1
locate kids, get vehicle, go up closest hill	1
make sure people close to you are safe, gather people to go to safe place	1
move away from water quickly to high ground or tree	1
move fast in the car, leave the camper	1
move higher up	1
move inland	2
move to high ground	1
move to higher ground	3
move to higher ground/ inland	2
notify campers, get to higher ground	1
pack up and get out quickly, tell others on the way out	1
pack up and go home	2
pack up and go inland	1
pack up and go uphill to watch it coming	1
pack up and head inland	1
pack up and head to higher ground	1
pack up and head towards hill	1
pack up car and get to higher ground	1
pack up everything and drive to hills	1
pack up family and minor possessions and go uphill	1
pack up kids, sort animals, take photos food, and water	1
pick up essentials, animals, and leave	1
prepare to shift stock to higher ground	1

put people in car and drive away	1
receding	1
run	1
run away to higher ground	1
run away, head for higher ground	1
run far from water, as far as possible	1
run for car	1
run for high ground	1
run for higher ground	1
run for higher ground with kids	1
run for hills	1
run for the hills, stay home, don't go to beach	1
run inland	1
run to higher ground	1
run to hills	1
run uphill	4
run uphill as fast as possible	1
run uphill to high ground	1
run, pack up supplies, head inland	1
seek high ground	1
seek higher ground	1
straight in car and go	1
take family and head inland	1
take family, water, warm clothing, animals, first aid, and go	1
take personal belongings and family and seek higher ground	1
take supplies	1
tell others, move uphill	1
try to get more information, prepare for evacuation, wait for advice from officials	1
try to get to high ground	1
warm clothes, get food, get in car	1

23. In the event of signs of a possible local-source tsunami, what actions would you take?	*n*
clear out right away	1
don't know	2
evacuate	1
evacuate beach	1
evacuate, get out of the way, take family	1
get away from beach	1
get away from the beach	1
get children, get in car and go uphill	1
get family, get uphill immediately	1
get in car and head high up	1
get in car and leave	1
get kids and head for higher ground	1
get out of the place	1
get out straight away	1
get people with flotation device and go 2-3 km inland and help organize people	1
get to higher ground	3
get uphill (stay here if here)	1
go faster to higher ground	1
go high up	1

go in car or uphill	1
go inland as fast as possible	1
go inland depending on traffic	1
go straight to hills	1
go straight uphill	1
go to high ground	2
go to high point	1
go to higher ground	1
go to higher ground and away from sea	1
go uphill	1
head for high ground or possibly the roof	1
head for higher ground	1
head for hill	1
head for hills	1
head for hills with kids, phone, water and wallet	1
head for the hills	1
head inland	3
just go with kids inland	1
just go, leave stuff, go to higher ground	1
leave and go to top of the hill	1
leave area quickly	1
leave coastal area and get well inland	1
listen for recommended actions, may not be practical to evacuate to road	1
look after kids, keep away from falling hazard	1
make sure to have enough food and water	1
move away from beach, grab kids	1
move away from water, keep away from trees, watch for road hazards	1
move to closer higher ground	1
move to shelter/safety	1
no time to do anything, run uphill	1
not enough time	1
not enough warning, seek shelter	1
not much you can do	1
nothing	1
provisions	1
run	4
run for hills	3
run to car and head uphill	1
run to hills	1
run to nearest high point	1
same	123
same but faster	2
same except leave cell stuff	1
same minus packing	1
same, go to school	1
same, grab kids and go	1
same, tell people as leaving	1
seek higher ground ASAP possibly up a tree	1
stay away from trees	1
stay away from trees, move away from water	1
take family, head inland	1

tell people to move off beach to higher ground	1
try to get clear of the of the area and away from falling trees	1
try to get to high ground	1
wait for word	1
walk uphill	1
yes	1

26. What do you expect from campground/accommodations staff during a tsunami?	*n*
account for people and evacuate to organized point	1
adequate notification, help evacuate people in an orderly manner to avoid traffic problems	1
advice, get people to safety	1
advise people to evacuate	1
announce the need for evacuation on the PA system	1
announcements	1
assistance to move	1
be responsible for selves, monitor people, stop people from panicking	1
be there to delegate leadership, get people to safety	1
broadcast information on PA system throughout campground including what to do and how long if time permits	1
calm, clear, concise directions to safe location	1
calmness, clear guidance as to what to do and where to go and wait for campers to evacuate	1
come and inform people	1
come and inform people of need to evacuate	1
come tell people	1
come through and evacuate camp	1
confirmation to get out, clear grounds and make sure people are gone	1
coordinate appropriate action	1
direct evacuation	1
direct people about where to go and what to do	1
direct people in calm and safe manner	1
direct traffic and people out, notify people, make sure people get to high ground	1
direction	2
direction, to have an evacuation procedure in place	1
don't know	2
drive around with siren to evacuate people	1
drive around yelling tsunami warning	1
drive through and tell people to leave	1
drive through with loud hailer	1
either self evacuate or warn people if there was time	1
ensure people were gathering and going to the right place (evacuating)	1
evacuate people	1
evacuate people and assist people and direct people	1
evacuate people as quickly as possible	1
evacuate themselves	2
expect instructions and knowledge of hazard	1
expect them to be informed about where to go, evacuation routes by foot, give orders, and be trained in first aid	1
follow safety procedures	1
for them to evacuate themselves after informing campers	1
gather people, give warning	1
get everyone out on road	1
gather to meeting point, not a lot, look after selves	1

give warning	1
give direction on what to do though there is only 1 person so not much	1
give notification	1
give warning, set off siren	1
give warning	2
give warning and direction	1
give warning and information, maintain organization and evacuate	1
give warnings, evacuate people	1
guidance	1
have a central meeting point and evacuation plan for people who don't know the area	1
have a meeting point	1
have a public warning system or loudspeaker	1
have a siren, alert people	1
have sirens set up to go off at intervals and give notice on PA and have a meeting spot	1
head fast inland	1
help campers, ensure safety	1
help evacuate people, give warning	1
help one another	1
here there is no need, check people	1
honesty, have a plan	1
if they had warning they would come down and warn people	1
inform campers of warning	1
inform people of safety procedures, have a meeting area, give out and information packet upon arrival	1
inform people to evacuate	1
inform people to leave	1
inform people, give warning	1
inform people, no time to pack up	1
inform people, take charge	1
inform visitors	1
information	4
information, gather people	1
instruct people, be knowledgeable	1
issue a warning to everyone	1
keep campers calm, advise people of evacuation route and if there is a need to leave	1
keep informed, precautions, inform people of where to go	1
keep people as safe as possible	1
keep people informed, help where possible	1
keep themselves safe, check on safety of campers	1
let people know, look after their own safety, have loud speakers	1
let you know, possibly help transport people uphill	1
locate people and make sure they leave	1
look after emergency supplies, accommodate extra time, information and updates, have emergency procedures	1
loud speaker announcement	1
maintain order, have an evacuation plan, have enough exits	1
make an announcement, have a place for everyone to gather	1
make people aware, have a system for notification	1
make sure gates are open	1
make sure people are aware	1
make sure people are evacuated	2
make sure people are aware	1

make sure that people are evacuated, have staff pass on messages and point out exits	1
not a lot	2
not a lot, fend for individual selves, inform people	1
not a lot, help warn people	1
not a lot, inform people	1
not a lot, set off siren or hailer	1
not a lot, to be involved with local Civil Defence after to locate people	1
not much	1
not much since there's not enough time	1
not much, have a hailer to inform people	1
not much, too few	1
not sure	1
nothing	15
nothing specific, all people would help	1
nothing, direct people to highest point	1
nothing, let people know with loud speaker	1
nothing, maybe alert people but most likely self evacuate	1
nothing, maybe loud speaker system to warn people	1
nothing, might use speaker system	1
nothing, people should know, possibly issue warning	1
nothing, people would have to evacuate themselves	1
nothing, possible warning but not enough time	1
nothing, too far away 2-3 km away	1
nothing, warning	1
nothing, would look after themselves	1
notice to tell people	1
notification	2
notification of tsunami	1
notification, instruction	1
notify about the event	1
notify people and make sure that people could get out	1
notify people to evacuate	1
notify people, have a system for orderly evacuation	1
organize campers and relief, have meeting locations	1
organize evacuation	1
panic like everyone else	1
pass around word	1
patrol and make sure people left, have manned meeting point	1
permanent people working together	1
person to come and give warning	1
run as well for a close one / warn people for a distant one	1
save themselves, warning	1
set off siren	1
set off siren, open facilities to house people after	1
shift people out, organize people	1
siren	1
siren, someone to direct traffic, tell people to leave belongings and go	1
some procedure	1
sound bell/ warning signal	1
stay and ensure safety of campers	1
support	1

tell as many people as possible	1
tell people and get out	1
to know warning sighs and be prepared	1
traffic directions, control of traffic	1
traffic management, inform people	1
try to help and make sure people evacuate	1
try to make people clam, be available to help others	1
unlock gates, evacuate people, give directions	1
use loud hailer	1
very little	1
warn people as soon as possible	1
warn people if there's time	1
warn people, direct people	1
warn people, public notification	1
warn people	1
warn/ notify people	1
warning	2
warning if possible	1
warning if time, warning may panic people	1
warning or siren	1
warning siren, exit at gate	1
warning to evacuate, drive around with a loud speaker	1
warning via siren	1
warning, be trained to evacuate people	1
warning, directions for exiting and keep order	1
warning, inform people of where to go	1
warning, inform people where best/ quickest exit is	1
warnings	1
warnings, set off sound system	1
would message from police and inform people to evacuate	1

28. Since the 2004 Boxing Day tsunami you:	*n*
appreciate damage capacity	1
broadcast working, give directions and time for evacuation	1
changed international communities need for warning system	1
determined risk	1
inform people	1
know more about devastation	1
less wish to visit prone areas	1
made emergency kit	1
more aware	9
more aware of possibility	1
more knowledge	1
sympathy and empathy for people, reluctance to travel to affected areas	1
think about risk more	1

Mail out survey

10. Which of the following make up the New Zealand's public tsunami warning system?
Police

Telephone calls
Word of mouth

11. What do you think would be the most effective was of delivering a warning?	*n*
-Get main internet suppliers to send out email to all subscribers and ask people to email it on. - Get Vodafone & Telecom (& any other providers to send out warning txt with instructions to all their subscribers. - for older/ sick people, door to door essential.	1
1. Siren- however in Sumner, Chch, this is a volunteer fire service warning so might not be recognized 2. Police or loudspeaker announcement. 3. door to door visit- if time.	1
2 above	1
2 and 3	1
2, 3, & 6 of qstn 10 Also phone.	1
2, 3, 4	1
2, 3, and 4 above... or my family calling from Canada which is how I heard about the warning 3-4 mths ago.	1
2. sirens & loud speaker 1. education as to [???] of evacuation	1
2/3/6	1
A "specific" siren	1
A continuous fire alarm	1
A continuous siren going with loud street announcements	1
A siren & if time radio & TV	1
A special siren would work well in Sumner. The fire and surf siren are heard easily otherwise loud speakers if distant. Plus radio/TV broadcasts.	1
A telephone tree	1
All communication available	1
All of above	2
All of the above	3
All of the above especially no 6 if there is time.	1
all of the above that I ticked	1
All radio & television stations announcing constantly	1
as above	1
beeping siren	1
By sirens	1
Depending on time of day. A distinct siren signal would be good. Additionally radio & TV.	1
distinct siren	1
Door to door	1
Door to door and beach sirens with a different sound for tsunami	1
door to door visits by emergency services or CD staff	1
Door to door visits to ensure everyone is alerted	1
flashing lights all over	1
Loud speaker	1
Loud speaker & sirens	1
loud speaker / door knocking	1
Loud speaker announcement, TV & radio announcements	1
loud speaker announcements	1
Loud speaker announcements, door knocking	1
Loudspeaker, sirens, radio, door to door. Different sounding sirens for fire, gas leak from local freezing works etc.	1
Loudspeaker	1
Loudspeaker plus radio TV.	1
Loudspeakers on mobile vehicle	1

Network of phone groups	1
Numbers 2,3,5,6 in question 10	1
pulsating siren up and down	1
Pulse siren that could be heard along entire coastline. TV & radio. Maybe no time for loudspeaker or door to door.	1
Radio	1
Radio & TV	1
Radio & TV announcements	1
Radio & TV announcements because most people have one or the other on during the day, but a very loud siren for nights	1
Radio & TV announcements, and sirens	1
Radio & TV plus sirens	1
Radio and TV announcements	1
Radio, TV- mobile loud speaker announcements	1
Radio, TV, Sirens	1
Radio/ Loudspeakers	1
Radio/TV	1
Radio/ TV blanket announcement. Helicopter/ bullhorn	1
siren	2
Siren	2
siren & radio/ TV announcement	1
Siren followed by radio announcements on every radio station	1
Siren for township	1
siren in Sumner	1
Siren, loud speakers, radio TV door to door	1
Siren, radio, & TV announcements	1
Sirens- radio	1
Sirens- special advertising & radio & TV	1
Sirens- with details of warning on radio & TV	1
Sirens	20
sirens & loudspeaker ann.	1
sirens & media	1
sirens & radio TV announcements	1
Sirens & then radio	1
Sirens (specific)	1
Sirens and Loudspeaker Announcements	1
sirens and radio & TV	1
Sirens as used in Hawaii & tested monthly	1
Sirens in area that we can hear!!	1
sirens loud speakers on poles	1
Sirens on our street/ not one central siren	1
Sirens or loud speaker announcements	1
sirens positioned within hearing of potentially affected persons	1
sirens that are different to the surf tower and fire brigade's so that they register with people as being a warning	1
Sirens then radio & TV announcements but there probably won't be time	1
sirens with distinct, known signals. TV/radio newsflashes	1
Sirens, all of the above	1
Sirens, announcements, door-to-door visits.	1
Sirens, loud speakers, telephone, door to door visits	1
sirens, announcements, radio & TV, door to door	1
Sirens, radio	1

Sirens, radio, TV	1
Sirens, TXT to mobile, Radio	1
Sirens/ loud speaker	1
Special Civil Defence warning with sirens	1
special siren	1
Special siren that is tested so people know that it sounds different to a fire engine or police	1
Special sound sirens	1
Specific coloured flares at 10 second intervals accompanied by an unusual siren sound- wirrrr- beep beep beep	1
Text Door to door Phone tree each phone in community calls 2 etc.	1
Text to all mobile users!	1
The above 3	1
The ones I've marked (i.e. 2, 5, 6) above.	1
the quickest & loudest way possible	1
TV announcements, radio announcements, text- mobile phone	1
TV door to door	1
TV, radio	1
TXT MSGS	1
Unique sounding siren. We have two sounding sirens already in Sumner.	1
Unsure as never been trialled	1

12. Who is responsible for issuing tsunami warnings?
A combination of all of the above? [Central Government, Regional Council, Local Council, Local Civil Defence group, Police or Fire Service, NIWA or GNS]
Central Civil Defence Headquarters
depends if national, regional, or local emergency called
First to notice it
Hawaii
Pacific Tsunami Warning Centre

16. Have you heard or received any information about preparing for tsunami hazards from any of the following?	*n*
back of phone book	1
documentary on TV, ads on TV	1
don't remember	1
EQC	1
EQIQ Website	1
Holiday in Hawaii, read literature	1
Local newsletter (Beacon)	1
local newspapers	1
media- community newspaper	1
Media & TV news/ back of phone book	1
newspaper	2
on TV	1
phone book	3
Reading books & newspapers	1
telephone book, civil defence	1
Television	1
Television advertising	1
TV	2
TV programs about tsunami	1

warning- yellow pages	1
yellow pages	2
yellow pages (phone book)	1

18. Have you asked any of the following people, groups or organizations for information on how to get ready for tsunami hazards?	*n*
went to an evening organized by the local rate payers	1

19a. If there is an official tsunami route please describe:
(I believe they are being prepared and we will be notified soon)
2 roads Bridge St. and Pages Rd
But it is not communicated, not practised and many people don't know.
details with Civil Defence using local bus company
Don't know about official- but head to highest point which in Kaikoura would be our peninsular water, tower (if there was room left & able to get there by road
Either up into hill where I live or to proceed inland.
Evacuation inland when CD alerts us
Family rules- head for hills- higher ground immediately. If poss. grab - food - warm clothing.
get to higher ground Kaikoura Peninsula if poss.
go to higher ground
Go to higher ground
I think so
Local civil defence group in charge
Main Road via South Brighton
Only 1 way out!! Rockinghorse Rd- Estuary Rd- Bridge St?
Only Road Out.
Proceed to high ground as soon as possible
Rockinghorse Rd, Estuary Rd, Bridge St-> inland
Seek higher ground via Bridge Street.
Straight out Rockinghorse Rd & Estuary Rd- no other way to go.
There is only 1 way out of our area (1 bridge across the estuary) so only 1 route possible.

24. Since the 2004 Boxing Day Tsunami you:
Am resigned to fate am disabled/can't walk/ can't drive/ avian flu may get me first
been more aware of the risks related to Tsunami
Have seen more preparation from local & central government agencies
Not more at risk as CD will alert us from the monitoring stations around the Pacific
Recent move to NZ from UK seems to be something to be prepared for.

25. Describe how you would respond to a warning of a local source tsunami.	*n*
- Quickly pack emergency camping gear & valuables in car & drive up the hill behind Sumner; Chch. - call friends on mobile and warn as many as possible	1
-get to higher ground quick.	1
a) action evacuation plan- food, water, dog, vital documents. leave	1
ask my wife to take me away	1
Attempt to move inland/ to higher ground immediately	1
Be prepared to move to safety ASAP	1
Being above the water level we would prepare to assist others from lower areas	1
Bike up the nearest hill	1
Collect- food- clothing- travel to higher ground- check whereabouts of household dwellers- If time check neighbours & friends-	1
collect family, drive away from coast	1

collect family. get necessities & drive inland as far away as poss.	1
Collect food- sleeping equipment- pets- travel to high ground	1
depart immediately for high ground	1
Depends whether you are at home.	1
Difficult we are 2.5k from access road to CH-CH via South Brighton	1
Don't know	2
Drive in land, get to higher ground	1
Drive inland. Take warm clothing/bedding/water	1
Drive my car up the hill to relatives	1
Drive or bike to escape	1
Drive to top of peninsula	1
Evacuate	1
Evacuate ASAP	1
evacuate the village immediately	1
Evacuate to high ground	1
Family, pets, and emergency box into car & move inland to relatives.	1
Gather children & husband/ wife provisions and leave area.	1
gather essentials, get in car, collect mother- may head out of town	1
Gather family & travel to higher ground	1
Gather quickly essential items & drive inland & away from rivers	1
get children go to higher ground	1
Get dogs & papers in car & drive to city centre/hills	1
Get family & move to less exposed area.	1
Get family in car & get to higher ground immediately	1
Get family, basic kit & run for hill behind.	1
Get in car & go down road toward nearest hill ASAP	1
Get in car with emergency provisions & sleeping bags & drive to top of Evans Pass	1
Get in my car & drive to higher ground	1
get in my car and head for higher ground	1
Get in the car and head for the nearest traffic jam which won't be far.	1
Get in the car with the dog- drive out?	1
Get my children from school/ kindly. Call husband to meet me at my parents house (other side of town)	1
Get out	1
Get out as quickly as possible (ASAP) driving.	1
Get out family, head for safe ground	1
Get out quick.	1
Get pets and wife and papers in car and drive inland if road isn't blocked by everyone else doing same. I think it would be.	1
Get the animals & move to higher ground	1
Get the family in the car with food, water & sleeping bags & drive in-land	1
Get to higher ground-	1
Get to the peninsula or if not there get inland as far as possible. Take supplies.	1
Get up the hill as fast as I could	1
Get uphill fast	1
Go as far inland	1
go inland	1
Go inland	1
Go onto roof	1
Go to high ground	2
Go to high ground if time	1

Go to high land	1
Go to higher ground - Port Hills	1
Go to higher ground	1
go to higher ground away from coast	1
Go to higher ground immediately	1
Go to higher ground in land	1
go to higher ground unprepared	1
Go to higher ground.	2
Go up a nearby hill.	1
go upstairs	1
Grab essentials (back pack prepared) to a higher ground	1
Grab evac kit, kids & pets. Head for hills.	1
Grab family & drive away.	1
Grab food & water container, some clothes & blankets- first aid kit etc. kept in car. Leave and drive to higher ground.	1
Grab food etc & head up hill 100m away.	1
Grab my survival kit, ring family nearby & get out	1
Grab our backpack and walk to higher ground.	1
grab photos and drive to hills (or bike if road blocked with cars as is only one road out) Go on roof if can't get out in time.	1
Grab some food, drink & warm clothes and walk/ run up Scarborough hill	1
Grab supplies, kids, animals and head for the hills	1
Head for high ground	1
Head for higher ground	1
Head for inland mountains, Southern Alps	1
Head for the hills	1
head for the hills take nothing	1
Head inland	1
head to the hills (local) 5-10 mins away	1
head up to hills- 5 mins drive- 20 min walk (with back pack kids etc)	1
I would drive to my son's school to pick him up and then drive inland	1
I would drive up the hill	1
If away from home (house which is on high ground) either return home or to high ground.	1
If the road along the coast was open I might go Kaikoura Peninsular- but I now live INLAND Rd- the wave might come straight up the Kowhai River- so would drive in front of wave towards Hamner.	1
If warned an hour earlier. I'd pack a bit of food & water & walk up Clifton Hill.	1
Kaikoura Muiri	1
Learn to swim.	1
Leave area immediately. Travel to higher ground by car.	1
Leave ASAP	1
Leave immediately, inland to high ground	1
Leave my home & travel to higher ground- immediately. Check that my neighbours are aware.	1
Leave the area by car. (inland) Dad would go to the pier as he thinks it would be high enough.	1
Leave the district	1
leave the vicinity and move as far away as possible	1
Listen to radio Climb a tree	1
Listen to radio.	1
Live on a hill	1
make sure warning was correct, then move up to higher ground. Scarborough	1

Move away from shore (home)	1
Move inland to higher ground	1
move inland.	1
Move inland.	1
Move rapidly inland and to a higher location (+30m)	1
Move to a safe area	1
move to high ground	1
move to higher ground	1
move to higher ground or inland	1
Move to higher ground.	1
move to hills	1
move to hills as quickly as poss.	1
Pack car with survival things & valuables.	1
Pack some essentials and leave right away.	1
Pack up and drive to high ground	1
Pack up family & get out.	1
Panic	1
Panic & head for hills.	1
Pray (I am an atheist)	1
Probably go to beach to look	1
Put emergency kit in vehicle & head for higher ground	1
Put in car & drive up hill with the rest of Kaikoura	1
Put my kids in the bike trailer & bike as far inland as possible	1
Put my pack in car & head for the hills as far away as possible	1
Quickly go to older neighbours & assist them, throw bike(s) in back of car, grab emergency bag and leave with house occupants & dog.	1
Quickly evacuate our home & travel inland.	1
Ride bike to top of Evans Pass	1
ring local friends, pack bag, turn off electricity, attempt to drive across town	1
Secure the Children (3) and drive up the hills	1
Seek family & move to high ground.	1
Seek higher ground	1
Stay at home on 3rd floor	1
Take animals & vital paper work and travel to higher ground or go inland away from sea and rivers	1
Take care and dogs to the top of the hills in Sumner immediately.	1
Take emergency supplies & get to high ground	1
Take food and supplies. warm clothes and blankets with my family and move inland to Hornby where my parents live (Also take important documents).	1
Take my survival pack and travel to high ground	1
Take pack of supplies, drive as far inland as possible (or to hills) and walk, run once we hit gridlock.	1
Take to the hills	1
Tell everyone, grab food & camera get to higher ground & film it	1
travel & go	1
Travel inland	1
Travel into city & stay with friends	1
Travel to high ground immediately	1
Travel to higher ground	2
Travel up to high land with my family	1
Try to contact friends/ family and quickly try to travel away from the coast by car.	1
Try to get as far away from the beach if the roads weren't in mass panic which I doubt	1

Use an official evacuation procedure.	1
Warn neighbours, take dog & valuable & drive towards Port Hills	1
Would collect emergency stuff & few key personal items	1
Would evacuate- away from coastline	1
Would get emergency supplies and our dog and drive inland 1 km or to higher ground (hills). but would worry about chaos & road congestion.	1
Would immediately drive inland, at least 3 kms.	1
Would prefer more time but would understand this might not be possible	1

26. Describe how your response to a warning from a distant source tsunami would differ from you response to a local tsunami.	*n*
- Take children, documents & valuables and drive up the hills & check neighbours	1
-more time to react	1
-same preparation but would only drive away if prompted to by local authorities	1
as above- but with less haste	1
as above	4
As above but have time to pack essential items.	1
As above but pack some stuff beforehand	1
As above.	1
Assist other to move out of area to be affected	1
Await for further information	1
await instructions	1
b) check all neighbours, assist evacuation with vehicles-plus plan a)	1
Be better prepared before leaving if necessary 1. water 2. food 3. clothing	1
Check expected arrival- go to higher ground with clothes & provisions	1
Contact Family in area. Take important documents, water, food, clothing, etc.	1
contact or listen out to local Civil Defence	1
Depends on degree of tsunami- move more personal stuff- high ground	1
depends on if it could reach here	1
Depends on severity	1
Drive further inland	1
Drive inland	1
Drive up the mountains	1
Evacuate and move everything from clinic to house.	1
Far less urgently	1
follow news/ warnings	1
Gather emergency supplies, clothing, valuables- personal documents & leave for higher ground.	1
Gather important belongings and then leave	1
Gather information when it was likely to strike then make sure I was on high/land with family.	1
gather more belongings	1
Get family, kit& run for hill behind.	1
Give some thought to what to remove from house & then above.	1
gives more time to secure property	1
Go to high land	1
Go to higher ground when warned	1
Grab food etc & go to sister's place to help with children, walk up nearby hill with them.	1
grab some food & clothes, warn neighbours, put kids in bike trailer, bike inland	1
have a lot of time to move to higher ground	1
Head for mountains	1
Head for the hills. With food etc.	1
I'd have more time to get extra things other than just self and dog.	1

I'd stop to grab my laptop.	1
I would be prepared and keep listening to radio & TV to reports for up dates	1
I would collect more valuables before leaving.	1
I would have more time to respond	1
I would pack supplies then vacate to move inland	1
I would still get out	1
I would think Aussie would take the brunt	1
I would wait for further information	1
I would warn & check more neighbours (door to door) & take chickens too.	1
I wouldn't PANIC. Await news of PROGRESS of approach & prepare to move if tsunami was thought to be a direct danger.	1
If more time avail, grab other valuables, jump in car & drive up hill or onto Port Hills.	1
if more time, gather belongings & travel & go	1
If time, take portable valuable items, raise valuable items & depart to brother's house on hill.	1
It would give me more time to warn/assist others.	1
it wouldn't	1
Keep informed through media move inland if necessary	1
Keep my radio on	1
Leave the district	1
Listen to local radio/TV of the likely effect and take appropriate action	1
Listen to radio first.	1
Listen to radio for info after it passes Hawaii & tsunami centre or for EM or CD updates	1
Listen to radio move to high ground	1
listen to radio reports and be prepared to go at any time.	1
Listen to radio. Get prepared to go if necessary.	1
Listen to radio/TV	1
Listen to TV and radio to see if it is going to effect me, but have car ready to go	1
Listen to warnings discern appropriate time to act-go.	1
Make sure of home[?] contained put more supplies in car	1
May feel I have a little more time to take documents and valuables in car with me. Also water, food, transistor, blanket)	1
maybe drive to higher ground	1
maybe nothing	1
Maybe take more time, take some essential possessions.	1
Might succeed in evacuating to high ground	1
Monitor the situation and be prepared to leave if required.	1
more care w/food & supplies. reposition valuable in house. 1. clothing 2. food 3. transport	1
more precautionary to mitigate damage to house. Take more vital possessions	1
More time to learn.	1
More time to leave- would probably grab a few more personal things	1
More time to pack all valuables etc. & to organize a place to go for a longer time.	1
move inland.	1
Move to higher ground if a risk was considered.	1
no action	1
no difference	1
no difference (only time)	1
no different	1
No different.	1
No rush	1
Not sure	1
not too worried- take time	1
orderly evacuation after confirmed hazard exists	1

organise to go somewhere that's higher ground & move to their home	1
pack & go inland	1
pack car with important things & go to hills	1
Pack clothes, food, bedding, water, family valuables, photos & get to higher ground. Listen to TV radio for more information.	1
Pack more carefully. Secure house, release animals then as above.	1
pack more stuff	1
Pack some belongings & get in the car & get to higher ground	1
pack up then head for the hills	1
Plan what you would do. e.g. where you will go/ what you will take.	1
Probably use the car & take some possessions	1
Prepare and take essential, food, clothing animals etc.	1
Prepare home- pack valuables. Listen for evacuation instructions.	1
Probably try to take animals with me and pack a bit more stuff in car. Would try to get out quickly though.	1
same as 25	1
Same as above but take document file and emergency supplies.	1
Same as above.	1
Seek information and prepare to leave	1
similar to above. but become more aware regarding local announcements	1
Stay where we are	1
Still get out	1
Take emergency supplies & get to higher ground	1
Take more e.g. food, photos	1
Take more things than emergency supplies, plan to go further.	1
Take necessities	1
Take note and wait for radio tele announcements	1
Take personal properties i.e. papers, medication etc.	1
time.	1
Travel to higher ground	1
Try to remove more belongings, personal things.	1
Turn on TV	1
turn on TV to get more info	1
unlikely to affect N.Z.	1
Wait & c what's going to happen BC I prepare	1
wait for advice to evacuate	1
Wait for instructions	1
Wait for instructions & respond.	1
Wait to be alerted that it will affect the East Coast of NZ	1
Wait until local warning systems	1
Watch the news	1
We would have <12 hrs warning therefore could remove valuables etc.	1
Will get more clothes food water, photos & extra blankets	1
will have more time to prepare	1
would collect important documents & more supplies food, water, medical supplies & leave further away	1
Would drive inland but would perhaps gather up a few precious possessions.	1
would drive up local hills	1
would expect a greater warning than one hour	1
Would grab clothes, necessities, water, & canned food to take with me.	1
Would have more time to decide	1
Would have more time to escape it.	1
Would have time to get out	1

Would not differ.	1
Would not feel a distant source tsunami would affect me, but would get a safety kit ready.	1
Would pack important stuff up and take it with me to higher ground	1
would respond the same if a definite warning was put out for NZ	1
Would still move rapidly to a safer place.	1
Would take time to lock house & call other family & friends to warn them.	1
Would try to take emergency pack & some personal effects	1
would wait for more information as to possibility and then go	1
Wouldn't immediately evacuate, would watch TV. for updates until evacuation became necessary.	1
Wouldn't panic	1
Wouldn't panic too much	1
Wouldn't respond other than listen to TV story, check with neighbours.	1
Wouldn't take as much notice	1
Wouldn't think it to be disastrous here?	1
Yes- keep listening for warning systems & be ready to move out.	1

32. If you currently have personal survival belongings stored to take with you when a tsunami warning is issued, please list the 3 most important?	*n*
1. (first aid/survival kit/medicines) 2. (clothing/sleeping bag) 3. (food & water)	1
1. all of my medication	1
1. animals 2. vital papers 3. food supply	1
1. camping gear (tent, gas cooker, sleeping gear) & food/water 2. laptop- all my work! 3. family photo album & will	1
1. Cheque book 2. sleep in van for inland travel 3. radio	1
1. clean water 2. food 3. tent/shelter	1
1. clothes 2. tent 3. gas cooker	1
1. clothing 2. food 3. transport	1
1. dog 2. water 3. food	1
1. emergency kit- food. mod. water. light 2. radio (battery) 3. Bedding/ tent/ passports etc.	1
1. essential medicine 2. bottled water 3. radio/torch- batteries	1
1. family treasure 2. family photos 3. water	1
1. father's ashes	1
1. first aid kit 2. change of clothes 3. emergency food/water	1
1. first aid kit 2. food (biscuits) for me and small dog 3. the knappack itself (for dog)	1
1. food & water 2. phone & radio 3. warm clothing & sleeping bags	1
1. food 2. clothing & blankets 3. communicator	1
1. food 2. first aid 3. clean water	1
1. food 2. medication 3. something for warmth	1
1. food 2. medication 3. water	1
1. food 2. water 3. all family members & pets	1
1. food 2. water 3. shelter	1
1. Food and H2O	1
1. food package 2. warm clothing 3. water	1
1. fresh water & food (plus cooking medium) 2. First aid kit & medicines 3. torch & radio with batteries 4. warm clothes- nappies	1
1. gas cooker 2. extra clothing-sleeping bags 3. water	1
1. Have water, batteries, toilet paper/tissues, waterproof clothing at ready.	1
1. insurance papers 2. water 3. clothes	1
1. lamp 2. sleeping bag 3. First aid kit	1
1. laptop 2. files 3. pictures	1
1. medical kit 2. warm clothing 3. food/water	1
1. medical supplies 2. warm clothing 3. food	1

1. medication	1
1. medication 2. food/ water 3. clothing/ sleeping bags	1
1. medication 2. insurance papers 3. jewellery	1
1. Medication 2. papers e.g. insurance etc.	1
1. medication 2. personal papers 3. food & water	1
1. Medication 2. photos	1
1. medication 2. water 3. food	2
1. medication 2. water 3. warm clothing to wear on evacuation.	1
1. medication 2. wet weather gear 3. food	1
1. medication, 2. papers-ID/ banking/ insurance 3. food &water	1
1. medication/medical records 2. financial/professional records	1
1. medicine 2. clothing 3. radio	1
1. medicine 2. water 3. food	1
1. medicine 2. water 3. warm clothes	1
1. medicines 2. additional clothing 3. passports	1
1. medicines 2. legal papers 3. family mementos	1
1. medicines 2. water 3. food	1
1. mobile phone 2. radio and battery 3. identification	1
1. my dog 2. medication 3. food, drink, supplies	1
1. my wife 2. my pills 3. my wheelchair & walking stick & mobility scooter.	1
1. passports 2. water 3. food	1
1. personal documents 2. food/ water 3. clothing	1
1. photos, 2. medicines, 3. a few clothes	1
1. pills 2. clothes 3. food (tins)	1
1. radio 2. food 3. clothing	1
1. survival kit (water etc) 2. Torch 3. Radio	1
1. The wife 2. the cat 3. me	1
1. tinned food 2. fresh water 3. radio	1
1. torch food water & sleeping bag	1
1. warm clothes & footwear 2. water & food 3. medication & torch	1
1. warm clothes sleeping bag 2. food & gas stove 3. cash & cards	1
1. warm clothing 2. torch 3. water	1
1. water- canned food 2. torch, radio (batteries)	1
1. water & food 2. medication (if needed) & communication (phone) 3. Warm clothing	1
1. water 2. basic food 3. first aid kit & warm dry clothing	1
1. water 2. blankets 3. food	1
1. water 2. canned food 3. blankets	1
1. water 2. clothing 3. food	1
1. water 2. dried food 3. medical box (first aid)	1
1. water 2. first aid 3. beer	1
1. Water 2. first aid kit 3. radio	1
1. water 2. food	2
1. water 2. food & cooking utensils 3. shelter i.e. tent & blankets	1
1. water 2. food 3. blankets	2
1. water 2. food 3. clothes	4
1. water 2. food 3. extra clothes with personal papers	1
1. water 2. food 3. Medical kit	1
1. water 2. food 3. shelter/ blankets/ sleeping bags	1
1. water 2. food 3. shelter/camping gear	1
1. water 2. food 3. sleeping bag & shelter	1
1. water 2. food 3. suitable clothing	1
1. water 2. food 3. warm dry clothing & tent	1

1. water 2. food. 3. first aid kit.	1
1. water 2. medicine 3. important documents	1
1. water 2. money 3. dry clothes	1
1. water 2. non-perishable food 3. medication	1
1. water 2. presc medices 3. food	1
1. water 2. radio & btys 3. warm clothing	1
1. water 2. radio 3. torch	1
1. water 2. survival blankets 3. dried food	1
1. water 2. torch/ batteries 3. radio	1
1. water 2. warm clothing 3. food	1
1. water 2. warm clothing 3. radio	1
1. water 2., food 3. warm jacket or blankets.	1
1. water/ food 2. clothing 3. important Documents	1
1. water 2. food 3. cooker-matches	1
Don't know	1
personal belongings not important	1
water	1

34. Please list the component's of your community's tsunami warning system?	*n*
-siren?	1
?	3
CDEM response, police fire action	1
Civil defence alarms	1
Civil Defence, police, council	1
continuous siren	1
continuous siren for fire etc	1
don't know	6
Don't know of anything.	1
Door to door visits maybe.	1
fire siren	1
fire siren goes off in one long sound, different from normal sound	1
fire/ like guard siren community- e.g. phone calls	1
freezing works siren	1
I do not know!!	1
I don't know what they are.	1
I have no idea!	1
I think the local siren would sound	1
move to higher ground	1
New Brighton & Sumner fire sirens	1
New Brighton fire alarm, police car PA warnings	1
none	2
none worth bothering about.	1
Not aware what exactly is in place but would assume the fire siren would sound and the radio would give warnings	1
Not sure - siren I think	1
Our problem is the fire alarm & civil defence alarm sound the same (rise & fall siren).	1
Police car sirens	1
Police, radio, siren	1
Radio & TV, fire brigade sirens	1
Radio TV Sirens	1
Radio. Police. Siren, Door to door visits	1
short blasts on fire siren- (our fire alarm is like this also, loud voice hailers	1
siren	3

siren & civil defence	1
siren & I assume loud hailers & radio & TV	1
siren at fir station	1
siren, local civil defence organisation, radio broadcasts (FM)	1
siren, loud speakers	1
siren, postie girl	1
siren, radio/ TV	1
siren, telephone- mobile phone	1
sirens	3
Sirens	1
sirens & radio & TV	1
Sirens / C.D. door knocking / Bullhorns etc	1
sirens door knocking radio	1
sirens, Civil Defence	1
sirens, police CD	1
sirens, radio	1
Sirens, radio, police	1
Sirens, Radio, TV, Police	1
sounding siren, radio TV broadcasts	1
There is not an official one.	1
There isn't one	1
There's a siren down the road somewhere	1
unknown/specific	1
unsure- only lived in area 3 months	1
we hope it's the siren!	1
works siren, radio	1

35. What advice have you been given about what to do during a tsunami evacuation?	*n*
?	5
absolutely none. It doesn't sell beach property.	1
Act cool as possible& follow instructions issued by civil defence& police	1
As yet have had none.	1
be fast	1
can't remember specifics	1
Don't take time gathering items, just get what you need & go.	1
Evacuate to safe area	1
Get as inland (or up) as possible! Have a backpack so when you need to abandon car you can carry essential supplies.	1
get inland fast!	1
get out as quick as can	1
Get out as quickly as can. A load of rubbish.	1
get to an elevation of 35m, have a pack already packed.	1
get to high ground- we have only 7 minutes	1
get to higher ground	2
get to higher ground and pack up your survival equip if possible	1
Go to higher ground	1
go to the top of the peninsular- but I have heard that down the coast- Oaro- is most likely which would affect me more now that I have moved to Inland Rd.	1
Have an emergency survival kit ready	1
haven't had any	1
head for hills	1
head for the hills.	1
Head to higher ground- above 35 meters above sea level or inland- 1 km	1

Head to higher ground	1
head to the hills	1
I have not!!	1
I know there is TV advertising & info. in the phone book	1
If at home stay put- if on low ground, get to higher ground or inland ASAP	1
Just be away, high above sea level, 35mts	1
Just what I read in yellow pages, take survival gear and go to high ground.	1
Leave ASAP	1
Leave soonest.	1
leave the area and go to a location 30m above msl	1
Listen radio & move to high ground 10 km inland listen to any civil defence instructions	1
Listen to radio and follow instructions from CD wardens	1
Move inland to higher ground, learn to swim	1
Move inland, do not go to beach	1
move to higher ground	2
move to higher ground immediately	1
NA	2
nil	4
no advice	3
none-only read the.	1
none	42
none so far	1
none that I can remember	1
none to my knowledge	1
none, yellow pages	1
None; but its common sense!	1
Not attended yet only in NZ for 5 months	1
nothing	4
Prepare emergency kit and get away as quickly as possible when warned	1
reach higher ground	1
run to high ground	1
See #19 [only 1 way out!! Rockinghorse Rd- Estuary Rd- Bridge St?]	1
take essentials leave in orderly fashion	1
take food & water and cooking supplies	1
Take survival pack and go to high ground	1
to get out asap	1
To travel away from our area to one of higher elevation as soon as possible	1
unsure	1
very little	1
warn others and make your way up peninsula	1

41. What are your main reasons for choosing to live in this community?	*n*
50% good air	1
affordable first home	1
away from the noise of the city	1
because we like the place	1
built/ leasing motel	1
cheaper housing	1
cheaper rent	1
close to my workplace	1
country life in township	1
economical & affordable	1
family	3

family are all handy	1
family members- mother, brother, sister	1
fresh air & slightly warmer	1
got married- moved	1
handy to work	1
House sitting but staying in community when house owner gets back	1
In small communities neighbours& friends are like family	1
It was cheap	1
It was the only house we could find.	1
My Turangawaewae	1
near employment	1
none	1
price	1
Quiet has good fencing for dogs and children	1
relaxed atmosphere	1
space	1
the community atmosphere	1
The general feeling of safety here all seem responsible people	1
The wife's sister	1
To be near family	1
views	1
village life	1
work	3
work proximity	1
work related	1

43. What are your main reasons for visiting this community?	*n*
business	1
family handy	1

45. Are you involved as a volunteer with any of the following in this community?	*n*
(retired) coastguard/lifeboat (after 18 yrs)	1
age 80+	1
am retired	1
boat club	1
Bowling club	1
Bowling club & working means club	1
caring for elderly in my area	1
church	2
coast guard	1
coastguard	1
community events & development	1
ex coastguard	1
Have done beach clean-ups	1
Justice of the Peace	1
lifelines counsellor	1
Lions	1
meals on wheels. church visiting. pre-school programme (music)	1
minister	1
neighbourhood watch	2
nil	3
no- stroke victim	1

no	6
not now	1
play centre	1
previously 3 [search and rescue]	1
PTA, kindy etc.	1
Residents assoc. executive committee	1
retire	1
rugby club	1
school	1
Takahanga Marae	1
Tennis club	1
too old!- 80yrs	1
victim support	1
was St Johns	1
weekly rubbish collection after all the careless people each weekend	1

48. If you are visiting this community where is your usual place of residence?
Avonhead, Christchurch
Christchurch, Sumner
Paton's Rock, Takaka Golden Bay

51. Which best describes the situation you are living in now?
alone but family nearby
Alone, but have partner & family
children every weekend
couple
NZ Kiwi
retire/ with married children in the same city
self plus wife
with daughter staying with me
with partner

52. To which ethnic group do you belong?	*n*
American	1
Dutch	1
European	1
Kiwi	2
New Zealand European and Maori	1
New Zealander	1
NZer	1
Swede	1